The UK Rail Sector

A showcase of world-class expertise

BUSINESS IS GREAT BRITAIN

Contents

Introduction

05 UK rail overview
09 Investment in UK rail
14 Showcasing international UK supplier capability and excellence

01 Planning, design and project delivery

20 Atkins
20 Laing O'Rourke
21 John McAslan + Partners
22 Clyde & Co
22 Mott MacDonald
23 Arup
24 JSA Architecture
24 Kier Group plc
25 Turner & Townsend
25 Weston Williamson
26 Steer Davies Gleave
26 WSP

02 Rail infrastructure and equipment

30 ASL
31 Camlin Rail
31 DeltaRail
32 Pandrol
33 GEOfabrics
34 Thales UK
34 Hawker Siddeley Switchgear
35 TRE
35 Tata Steel
36 Mechan

03 Rolling stock

40 Bombardier
40 Brecknell Willis
41 Hitachi
42 Creactive Design
42 David Brown
43 Alstom
43 Rowe Hankins
44 Interfleet
44 Pickersgill-Kaye
45 Siemens
45 Ultra Global PRT
46 Unipart Rail
46 Rail Interiors Solutions

04 Asset management – services, technology, maintenance and renewal

50 Network Rail
50 Atkins
51 Perpetuum
51 London Underground
52 Thales UK
52 Serco
52 Nomad Digital (Nomad Tech)
53 Balfour Beatty
53 Instrumentel
54 Tracsis

05 Safety and security

58 Network Rail Consulting
58 Lloyd's Register
59 Atkins
59 Zonegreen
60 Arcadis EC Harris
60 Vysionics

06 Operations

64 Arriva
64 National Express
65 Freightliner
66 Serco

07 Ticketing

70 ACT
70 Masabi

08 Training

74 Babcock
74 TUCA
75 Bridgeway Consulting
75 The National Skills Academy for Railway Engineering (NSARE)
76 National Training Academy for Traction and Rolling Stock (Siemens)

09 Innovation in action

81 Railway Industry Association
81 Aerospace lift for train door design
82 FutureRailway Enabling Innovation Fund
82 The Technology Strategy Board
83 DIFCAM
83 Virtual Lineside Signalling
84 Collaboration on energy-efficient powertrain systems

10 Research and education

88 RRUKA
88 University of Southampton
89 University of Birmingham Centre for Railway Research and Education
89 Imperial College London – The Future Rail Research Centre (FRRC)
90 NewRail – The Centre for Research at Newcastle University
90 University of Sheffield
91 University of Huddersfield Institute of Railway Research
92 University of Nottingham

93 More information

Introduction

As the pioneer of railway development, the UK is at the forefront of building even bigger and better rail systems, as well as managing and enhancing a long-established network.

What's more, rail privatisation and liberalisation of the market place, which the UK has led, have not only worked to support new train operating companies but have also driven a more innovative, and financially efficient, industry.

Such experience means the UK has extensive benefits to offer the global rail market.

In this publication we highlight the success of the UK rail industry, recent and current investment, and the UK supply capability that's working for rail clients all over the world.

On these pages you'll find insight to:

- planning design and project delivery
- rail infrastructure and equipment
- rolling stock
- asset management
- safety and security
- operations
- ticketing
- training.

We also put the spotlight on how UK rail innovation is being supported, and the role played by the UK's research and education institutions.

This is not a comprehensive directory, but an overview of UK capability, with case studies as exemplars of what UK organisations can provide.

Companies have been included mainly on the basis of their exports work. Many of them operate in more than one sector but have been referenced in one only.

To talk more about how UKTI can help with your rail development, contact the British Embassy or Consulate General in your country, who can put you in touch with a UKTI representative. Or visit the UKTI website at www.ukti.gov.uk for more information.

Seeing the longest sustained growth in history, today's network delivers 1.5 billion passenger journeys a year.

Image: John McAslan

UK rail overview

Safer, more reliable and more punctual – the UK's rail industry has moved on significantly in recent years.

Highlighted by stronger performance and punctuality scores, these achievements – which include more frequent journeys between major cities – are reflected in the higher passenger approval and safety ratings received by the UK's railways.

What's more, a decade of unprecedented growth has gone hand in hand with that improved performance. Record numbers of passengers have been travelling on the UK mainline railway network, reversing a downward trend. Seeing the longest sustained growth in history, today's network delivers 1.5 billion passenger journeys a year. Since privatisation 20 years ago, passenger kilometres and journeys have more than doubled.

This rail passenger growth has outperformed key external drivers of demand, such as population or employment, taking a bigger share of the passenger market. In fact, the rate of growth in train journeys has been twice that of GDP, even though the costs of rail and car travel have broadly mirrored each other. Rail passenger growth in the UK is greater than all other European countries, including France, Germany and the Netherlands.

Light rail, tram and metro networks are set to continue to grow strongly in the UK, with passenger journeys on the eight key networks increasing by 9 percent annually. The London Underground (LU) network alone makes around 1.2 billion journeys every year. LU connects the capital via 11 lines, 270 stations and 402km of track, with each train travelling on average 126,000km each year.

Remaining a significant driver for the UK economy, the UK rail industry accounts for expenditure of around £12 billion per year and provides more than 200,000 UK jobs, with around 40 percent of those in the supply chain.

Image: UKTI

Set to keep growing

This growth is set to continue well into the future, with train operators and Network Rail planning to accommodate an extra 400 million rail journeys on the mainline network by 2020. The industry's business plan is for 20 percent more capacity into and out of central London at peak times, and a 32 percent increase in seats into and out of large regional cities.

Looking even further ahead, passenger kilometres are forecast to double over 30 years from 2010 levels, with similar predictions for the growth of freight moved in tonne kilometres.

Meanwhile, many major new rail investment projects amounting to billions of pounds are underway or planned, including Crossrail, Thameslink, Intercity Express Programme, Edinburgh to Glasgow Improvements Programme (EGIP) and High Speed 2.

Satisfied customers

The UK's railway rates as one of the best major networks in the European Union, according to rail passengers who were asked for their opinion in 2013.

Of the 26 countries covered in the European Commission survey of more than 26,000 Europeans, only Finland, with a much smaller, less complex rail network, scored a higher overall rating than the UK.

The survey examined rail passengers' satisfaction with domestic rail services, including trains, railway stations and accessibility for people with reduced mobility.

The UK topped Europe's seven major railways in the specific areas of punctuality and reliability, information during journeys and accessibility – some of the key areas focused on in the study.

Competitive and open

The UK has pioneered privatisation and liberalisation of railway systems, with other European markets undergoing similar transformation.

Privatisation of the UK's rail network has provided investors and companies, both foreign and domestic, with a far more open and competitive market than most European counterparts.

Having many passenger rail companies operating on various parts of the network rather than one large public body means investors can engage in the UK market much more freely.

At the heart of today's UK rail success story lies a strong partnership between the public and private sector. This partnership generates passenger growth by providing commercial expertise in market growth and an industry focused on attracting more rail users.

Indeed, working through Network Rail, successive governments have invested in the UK's national rail infrastructure. Meanwhile, competition has been driven between private train operating companies to win franchises to run passenger services, putting the emphasis on commercial efficiency and continuous improvement. Under the franchise system, train operators have continued to innovate, and to meet passenger expectations.

Chain of innovation

Liberalisation of the market has fostered competition from suppliers and manufacturers from the UK and abroad, helping support a diverse, competitive and innovative supply chain. This in turn has enabled new projects and improvements in the UK rail infrastructure.

Accounting for a turnover of £7 billon and 80,000 jobs, the UK rail supply chain makes a significant contribution to the UK economy; it is stable and gaining in strength, with new suppliers coming on board to service the UK and international markets. There's also a growing body of institutional support and collaboration initiatives for transport (read more on page 77).

The UK supply chain is active globally and leads in many areas, but manufacturing and equipment exports currently only represent some 10 percent of revenues. So there's significant scope to increase UK rail exports, and for UK expertise to further benefit the global market.

Safety in numbers

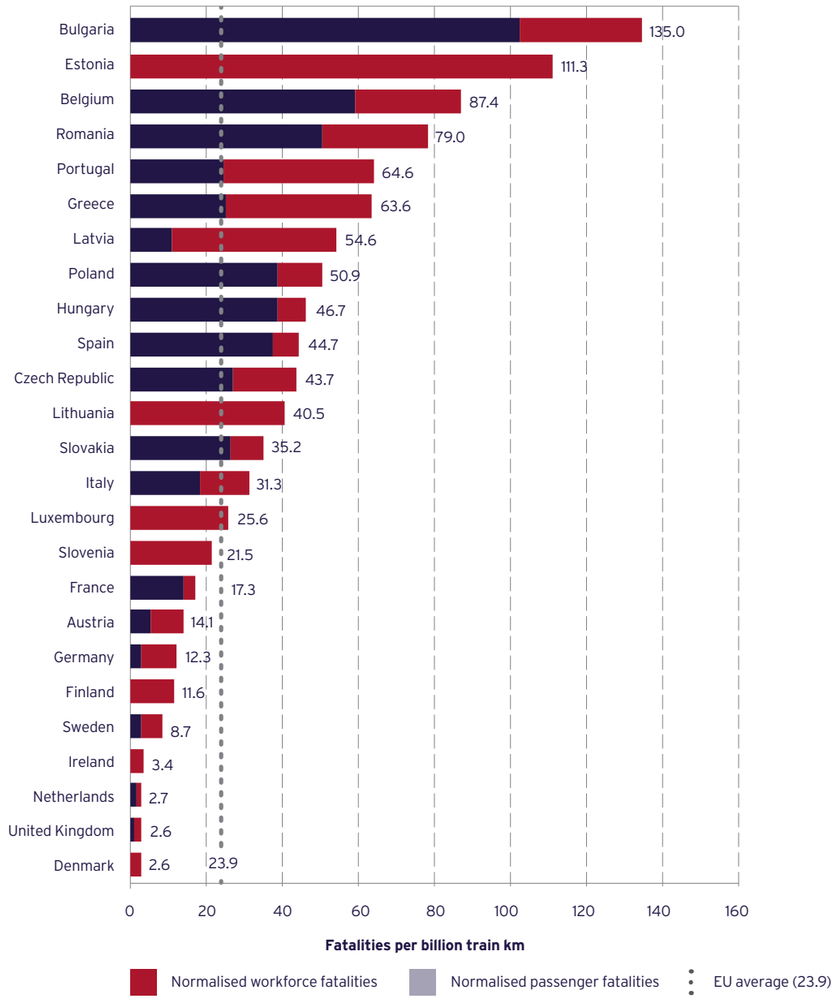
The UK has one of the safest rail networks in Europe; safety is at the heart of how the railway is designed and managed and is integral to its success.

EU statistics show that from 2007 to 2011 there were 0.0026 fatalities per million train kilometres, which is equal lowest with Denmark (source: Eurostat).

The railway industry has pledged to reduce safety risks for passengers, the public and its workforce, not just in the next five years, but for generations to come. Network Rail continues to invest in the safety of the UK rail network; for example, it has invested £130 million to make level crossings safer or close them by April 2014. Through such initiatives, Network Rail aims to reduce the number of accidental deaths on UK rail lines to zero.

London Underground is one of the safest railways in Europe. Over the past decade-and-a half its level of safety has increased by six times (comparing frequency of major incidents), from what was already a good record. This is thanks to a continued focus on health and safety for customers, public and employees. A programme of investment is currently underway to further improve the reliability, safety and capacity of the Underground. This will help ensure that an already excellent safety performance keeps improving.

Passenger and workforce fatality rates on European Union railways 2007-2011



Investment in UK rail

The significant investments being made in the UK rail infrastructure are not just testament to the UK Government's commitment to invest in rail but also to the capability of UK companies to deliver this major ongoing programme of works.

Here, we showcase some major projects: some completed, some under construction and some planned.

Intercity Express Programme

The Intercity Express Programme (IEP) comprises the infrastructure, rolling stock and franchise changes needed to replace the fleet of Class 125 and 225 trains that operate on the Great Western routes (GWML) and East Coast Main Line (ECML). These faster, higher capacity and more environmentally sustainable trains will improve the passenger experience and support growth along the corridors they serve and through their manufacture and supply chain. Agility Trains, a consortium made up of Hitachi and John Laing, is to build 122 new trains and is an excellent example of world-class companies working together.

Rail Investment Strategy (formerly High Level Output Specification)

As part of the UK Government's vision for a better, faster and greener railway, the £9 billion Rail Investment Strategy, announced in 2012, provides for railway upgrades across England and Wales for the period 2014 to 2019. This includes upgrading stations and tracks to create enough capacity around cities for an additional 140,000 passenger journeys daily at peak commuter time.

The Scottish Ministers published a separate HLOS as part of a £5 billion package of funding and investment in Scotland's railways between 2014 and 2019. This will support Network Rail's delivery of a number of major rail projects as well as a rolling programme of network electrification to improve performance and journey times and reduce emissions.

Electrification

To cut down on CO_2 emissions, reduce operating costs and speed up journeys as part of a long-term programme, the Government is electrifying railway routes to phase out the use of diesel trains. By 2020, around three-quarters of all passenger kilometres will be by electric train.

Crossrail

Europe's largest construction project, Crossrail, is a £14.8 billion scheme that will create a new transport infrastructure to support London's economic growth. Running under central London, it will deliver faster journey times and a 10 percent increase in London's rail-based capacity.

The first Crossrail services through central London will start in late 2018. Bringing an extra 1.5 million people to within a 45-minute commuting distance of London's business centres, it will also lead to the creation of up to 30,000 jobs by 2026 in central London.

The route will run for more than 100km from Reading and Heathrow in the west to Shenfield and Abbey Wood in the east, involving the construction of 42km of new tunnels under central London. The 38 Crossrail stations will include nine new stations at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street, Whitechapel, Canary Wharf, Custom House and Woolwich.

Crossrail Ltd, a special-purpose delivery body set up to deliver the project, is constructing Crossrail. Jointly sponsored by the Department for Transport and Transport for London (TfL), it's a wholly owned subsidiary of TfL.

Thameslink Programme

As a result of the £6.5 billion Thameslink Programme, rail passengers will see more frequent and less crowded trains on one of the south-east's busiest rail routes. The trains will be lighter, more reliable and more energy efficient.

This Department for Transport Programme comprises the upgrading of infrastructure, the deployment of new rolling stock and the introduction of a new Thameslink franchise to achieve 24 trains per hour through London's core, almost doubling current capacity.

The investment in infrastructure will allow longer trains to run with new, fast and frequent London connections to towns and cities both north and south of the capital. Significant investment has been made in Blackfriars and Farringdon stations and longer 12-carriage trains have been introduced.

Looking ahead, redevelopment of London Bridge Station is underway and will be complete by June 2018.

Wales

A £300 million scheme to electrify more than 160 route kilometres of the South Wales local network is being sponsored by the Welsh Government. This scheme is planned to be completed in 2019 and enables the 30-plus year old diesel fleet of passenger trains to be replaced by faster, quieter and more environmentally friendly electric trains. The growth in the use of rail into Cardiff, the Welsh capital city, has averaged 5 percent a year in the peak commuter time and electrification helps deliver the extra capacity needed.

Edinburgh Glasgow Improvement Programme and the Borders Railway

The Edinburgh Glasgow Improvement Programme (EGIP) is a comprehensive package of improvements to Scotland's railway infrastructure. The first phase of the scheme includes modernisation and upgrades to key junctions and infrastructure as well as widespread electrification of the Scottish rail network, including the main line between Edinburgh and Glasgow. As part of the programme the £25 million redevelopment of Edinburgh Haymarket station was completed in December 2013.

The Scottish Government has provided investment of £353 million for the Borders Railway, which will re-establish passenger railway services between Edinburgh through Midlothian to Tweedbank for the first time since 1969. The 48 kilometres of new railway and seven new stations will deliver major economic and social development opportunities and offer a fast and efficient railway. Construction of the Borders Railway is on schedule for completion in June 2015, with passenger services available by September 2015.

Major mainline upgrades

The UK is upgrading a number of major main lines and stations so longer, faster trains can operate more frequently. Alternative routes are being provided to enable growing freight traffic to stay clear of the fast intercity trains. Lines being upgraded in the UK as part of the Strategic Freight Network include the Great Western Main Line, Transpennine, Midland Main Line, East Coast Main Line and the link from Felixstowe to Nuneaton.

High Speed – High Speed 1 and High Speed 2

The UK currently has one high speed line, High Speed 1 (HS1), running between St Pancras in London and the Channel Tunnel, connecting with international high speed routes and serving a domestic commuter route.

We are planning to build a further high speed line, High Speed 2 (HS2) to meet future needs. Even with the extra capacity being delivered through the mainline upgrade programme, the UK will run out of space by the mid-2020s on the West Coast Main Line.

With construction expected to start in 2017, the new HS2 project will provide a high speed rail connection between London, Birmingham, Manchester and Leeds, forming the "Y" network.

To ensure its benefits can be swiftly realised, the Y network will be delivered in two phases: Phase one will deliver the London to West Midlands line with a link to Europe via HS1, and phase two will extend the line to Manchester and Leeds. Completion of HS2 will free up capacity on existing lines for services to intermediate towns and cities where trains already run at around 200kph.

Major station redevelopment

The UK has seen a significant programme of station redevelopments in recent years, and that's set to continue. Completed projects of note include St Pancras, King's Cross, Stratford, London Blackfriars and Newport, while ongoing projects or those nearing completion include Reading, Paddington, Birmingham New Street, London Bridge, Farringdon, Edinburgh Waverley, Manchester Victoria, Peterborough, Waterloo and Nottingham.

Here, we highlight several of those projects.

• St Pancras International

St Pancras International Station is one of the biggest landmarks in London and serves as a gateway to Europe. It's used by 45 million passengers annually and is the UK home of Eurostar.

The station was designed by William Barlow for The Midland Railway and opened in 1868. But over time it fell into decline and by the time restoration plans were announced in the 1990s it had become a sad symbol of UK railways neglect.

Happily, the station reopened in 2007 following a £800 million redevelopment plan that saw it restored to its Victorian-era glory, with added retail and hospitality areas.

The new station has 13 platforms, six of which are more than 430m long and being used by Eurostar. A key feature of the stations remains William Barlow's train shed roof, which at 30.5m high and 74m wide, remains the largest of its kind in the world.

The Grade I listed St Pancras International has won numerous awards since being reopened and stands as a glittering emblem of what the future holds for UK railways.

• Reading

Reading is one of the busiest parts of the country's rail network and its complicated track layout restricted the number of trains that could run. Network Rail is improving the track layout, constructing new flyovers and building new platforms and entrances at the station to decongest the railway and improve passenger and freight journeys. The project has funding of £850 million and will deliver a 37 percent improvement in train service performance, and provide more capacity for additional services to meet growing demand. A new depot has also been opened. The project is expected to be complete a year early, by 2015, which is testimony to the close co-operation of industry partners.

• King's Cross

King's Cross lies at the heart of the busiest transport interchange in the country.

Network Rail invested more than £450 million redeveloping and restoring the station in one of the most significant infrastructure and regeneration projects in the UK over the last decade. Despite the major disruption to an important rail hub a full train service was maintained throughout the improvement work.

The Victorian structure was renovated and expanded to create a transport hub ready to accommodate the unprecedented numbers taking to the railways. The bright, spacious new concourse is the largest single-span structure in Europe. It opened in March 2012 in time to welcome the world for the Olympics.

The rest of the project was completed in 2013, revealing the original station facade for the first time in 150 years, and opening the just-under 7,000 sq metres King's Cross Square in front of the station.

The station redevelopment has been the catalyst for one of the largest regeneration schemes in Europe, attracting £2.2 billion of private investment. With 27 hectares of brownfield land being developed into offices, retail and 2,000 homes, Google, BNP Paribas, University of Arts London and others are building a future in this thriving area of London.

• Birmingham New Street

The £600 million New Street redevelopment will see the current 1960s-built station transformed into a bright, modern, 21st-century focal point for Birmingham. The project will bring major economic growth by creating new jobs and stimulating regeneration.

When the project is completed in 2015, the station will be wrapped in shimmering, carefully crafted stainless steel and include a giant atrium, allowing natural light throughout the station and to platform level. The new concourse will be two-and-a-half times bigger, giving more space for the 140,000 passengers who use the station every day.

The station plans also support the extension of the Midland Metro tram system that will run through the heart of the city, terminating at New Street station.

• Edinburgh Waverley

Edinburgh Waverley Station is of critical importance to Scotland's historic, environmental and commercial wellbeing, as well as being key to delivering capacity for new rail lines, such as the reopening of the Airdrie-Bathgate Rail Link.

Britain's largest railway station outside London, it has approximately 23.5 million users per year and climbing. Over the past 15 years, the number of trains has increased by 50 percent to more than 600 per day.

Edinburgh Waverley has been transformed by a £130 million investment in the station and its facilities, creating an environment that meets the needs of passengers in the 21st century while preserving Waverley's rich heritage.

The renewal programme included replacing the station roof, providing better accessibility and facilities for station users, refurbishing the station concourse and main building exterior, and improvements to platforms.

- **London Bridge**

As part of the Thameslink Project, Network Rail is transforming London Bridge into a bigger and better station, including new platforms for more trains and a new concourse.

London Bridge is the fourth busiest station in the country, bringing around 50 million passengers into the city each year. The changes will allow more Thameslink trains to run every day – one every four minutes at peak time – offering better connections than ever before.

The concourse at London Bridge station will be bigger than the Wembley Stadium pitch, boasting new retail and station facilities. Connections to and between the surrounding areas will be improved, supporting the wider regeneration of the area. There will be better Tube and bus links, and lifts and escalators will provide step-free access to every platform.

Reconfiguring the track will allow for nine 'through' platforms and six terminating platforms. This will mean more trains to more destinations, including a connection to Crossrail services at Farringdon, providing links across and beyond London in all directions.

London Bridge station will remain open during the transformation while scheduled amendments to train timetables will allow work to be carried out.

- **Farringdon**

From 2018, Farringdon station will be the focal point at which Thameslink, Crossrail and Underground services meet. From there, passengers will have the choice to travel north-south, east-west or around London.

With 160 trains an hour in the peak it will be the capital's newest transport hub, relieving the pressure on the Underground and delivering thousands more seats for commuters every day.

There will be direct links to London's three major airports, Heathrow, Gatwick and Luton, and to St Pancras International for Eurostar services – plus dramatically reduced journey times.

Metro projects

London Underground is undergoing a major renewal that will result in more comfortable journeys and a faster, more reliable service. A number of train fleets are being replaced or enhanced to increase the capacity and frequency of the service. The Victoria line, after its upgrade, now provides one of the most intensive train services in the world.

Stations are being modernised with upgrades to CCTV, lifts and escalators, improved fire prevention systems and public address systems. Major work to reduce overcrowding is happening at key interchanges including Victoria, Paddington, Tottenham Court Road, Bank and Bond Street.

Tram projects

More extensions to existing networks are underway, including Manchester Metrolink, Midland Metro Line One into Birmingham city centre and to the Nottingham Express Transit system.

The UK's first tram-train service is also being developed – it will run between Rotherham Parkgate and Sheffield City Centre, operating on both the existing tramway and the national rail network. The service will start in 2016, once the route is upgraded and the new vehicles manufactured and delivered.

Meanwhile, a new tram system in Edinburgh has been developed and services will begin in 2014.

Showcasing international UK supplier capability and excellence

UK suppliers are actively working around the world to help other people build new rail systems and manage their infrastructure and operations. Collectively, UK companies deliver virtually all the capability needed to support all the elements of rail system implementation: from inception, planning, design, procurement, specialist equipment supply, construction, test and commissioning, through to operations, maintenance and whole-life asset management.

UK-based companies and suppliers have the skills, expertise and global experience to develop new rail systems or to improve and expand existing ones. We have a reputation for delivery, being innovative and providing best-in-class products and services.

Why choose UK suppliers?

- Along with sustained growth in passenger numbers and expansion plans for UK rail's national freight and passenger rail network, there's the development of numerous new urban mass transit systems, and extensions to existing ones.
  These new systems must integrate different types of transport to meet the travel needs of major cities and conurbations.
- Privatisation of the railways, either wholly or in part, has brought considerable benefit and improvement to the UK rail services – and these services now have to be competitive and, wherever possible, commercially viable. This has also opened up the UK market to competition from other international suppliers, many of whom are now established and resident in the UK supply chain.
- There are now metrics that seek to maximise rail reliability, availability and levels of customer service. This has meant the UK has introduced a culture of focusing on the provision of services and minimising the risks of failure.
- The UK has some of the most technologically advanced and reliable rail systems in the world, which we're rightly proud of. We also have the know-how and expertise to bring this total capability to bear in the introduction of new rail systems worldwide, through our extensive network of UK suppliers.

Connecting with the right supplier

In providing an overview of UK rail capability, this brochure features some of the many UK-based suppliers who deliver rail equipment and services across the globe.

And with its wide range of contacts and specialist knowledge, UKTI can help put customers in touch with the right suppliers for their needs.

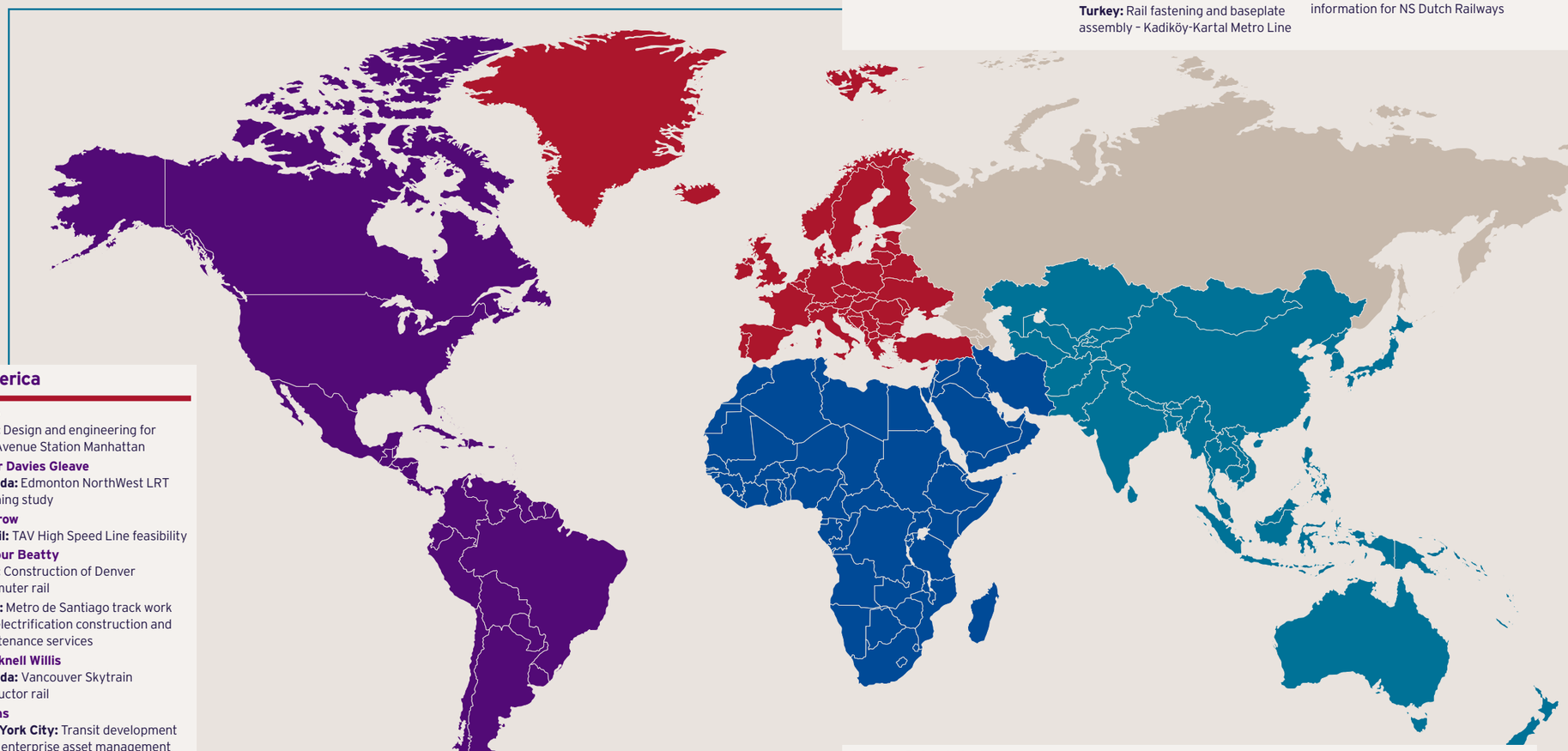
However, UKTI also works closely with organisations such as the Railway Industry Association (RIA), which provides a collective voice for many UK-based companies. While members are able to access services and advice through RIA, equally, customers can be quickly put in touch with suppliers who can provide the right service for them. RIA's website search facility enables customers to quickly find the RIA members that can best help them (see www.riagb.org.uk).

The Rail Alliance also has a comprehensive resource in the shape of its online searchable capability database, essentially a supply-chain matchmaking tool for connecting buyers with sellers (see www.railalliance.co.uk). The Rail Alliance uses extensive contacts to enable businesses to network with each other, and also with other experts with key industry knowledge.

Bodies such as the Derby & Derbyshire Rail Forum (DDRF), which is able to draw on the expertise of local authorities and other industry groups for the benefits of its members, are also invaluable to the continued growth of what is already a robust UK supply chain. You can view DDRF's online member directory at www.derbyrailforum.org.uk/members

Delivering across the globe

UK companies have the skills and experience to meet the equipment and service needs of rail systems worldwide.



Europe

Mott MacDonald
Norway: Design for Bergen Light Rail

Atkins
Denmark: ERTMS signalling upgrade
Denmark: Technical and procurement consultant for Copenhagen Metro Cityringen

Balfour Beatty
Switzerland and Italy: Gotthard Tunnel rail systems services

Lloyd's Register
Spain: Independent quality inspection services for Metro Madrid's new Series 3000 metro vehicles

Pandrol
Turkey: Rail fastening and baseplate assembly – Kadiköy-Kartal Metro Line

LPA
France: supply of rolling stock interior LED lighting to AGV (Alstom new high speed train), TGV East, Corail Intercity and AGC (regional train)

Nomad
Netherlands: Real time travel information for NS Dutch Railways

Arriva
Poland: Train operations

Freightliner
Poland: Rail haulage operations

Interfleet
UK: Certification activities for Hitachi's High Speed Electric Multiple Units

America

Arup
USA: Design and engineering for 2nd Avenue Station Manhattan

Steer Davies Gleave
Canada: Edmonton NorthWest LRT planning study

Halcrow
Brazil: TAV High Speed Line feasibility

Balfour Beatty
USA: Construction of Denver commuter rail
Chile: Metro de Santiago track work and electrification construction and maintenance services

Brecknell Willis
Canada: Vancouver Skytrain conductor rail

Atkins
New York City: Transit development of an enterprise asset management concept, framework, and implementation roadmap

Asia Pacific

Mott MacDonald
India: Gurgaon Metro – detailed design for six stations
Taiwan: High speed rail asset management strategy

John McAslan + Partners
India: Delhi Metro stations

Hyder
Australia: Ulan+ alliance track, civil and structural design

Atkins
Hong Kong: Detailed design for Hung Hom Station and associated tunnels

Laing O'Rourke
Australia: Multiple projects including track construction BHP Billiton RGP5 and Novo Alliance Sydney Rail infrastructure upgrade
Hong Kong: Multiple projects for MTR including Express Link and South Island Line

Balfour Beatty
Australia: Overhead Catenary System. Queensland.
Malaysia and Singapore: Electrification and trackwork

Brecknell Willis
China: Rail and system components – Beijing Metro Line 5

Knorr Bremse
China: Braking systems for over 10,000 metro carriages

Freightliner
Australia: Rail haulage operations

Arup
Hong Kong: Infrastructure and knowledge management for MTR

Interfleet
New Zealand: Rail operational modelling and network simulation for Auckland Transport Authority

Africa & Middle East

Roughton
Nigeria: rail consultancy to the Government of Nigeria

Interfleet
South Africa: Assistance to PRASA's rolling stock replacement strategy

Atkins
Saudi Arabia: design and engineering for Makkah Metro and Riyadh metro lines 4, 5, 6

Foster & Partners
Saudi Arabia: Design of Haramein stations

Turner & Townsend and Parsons Brinckerhoff
Qatar: Integrated Rail Programme

Lloyd's Register
UAE: Independent safety assessor for Dubai Metro and Etihad Rail
Saudi Arabia: Northern section of the North South Line

Holdtrade
Ghana: Mining railroad rehabilitation and maintenance

Mott MacDonald
South Africa: Transnet rail project programme management

Bombardier
South Africa: Rolling Stock and Fixed Systems – Gautrain Project

Serco
Dubai: Dubai Metro operations and Al Sufouh Tram operations

01 Planning, design and project delivery

Features

20 Atkins
20 Laing O'Rourke
21 John McAslan + Partners
22 Clyde & Co
22 Mott MacDonald
23 Arup
24 JSA Architecture
24 Kier Group plc
25 Turner & Townsend
25 Weston Williamson
26 Steer Davies Gleave
26 WSP

Image: Crossrail

Planning, design and project delivery

UK capability in planning, design and project delivery is rightly recognised around the world for its excellence. The UK is home to some of the best legal firms, architects, engineering consultants, programme managers and contracting businesses working in the rail sector.

UK companies are active in international projects across commercial and legal services, transport strategy and planning, engineering and design, procurement, programme and project management, and construction. They can support every phase of a project, from advising at the earliest stages on the best transport mode to adopt right through to commissioning.

Flexible and adaptable, UK suppliers often partner with other nations' suppliers to forge the strongest possible offer to clients. Such a co-ordinated response can gain the edge over competitors, not only on quality and price, but the proven products and capability that come as part of that collaborative package mean clients are presented with a low-risk solution.

The wealth of original thinking found in the UK ranges from award-winning uses of building information modelling processes, to designing for complex engineering challenges. And whether a government is looking for advice on a project that will have a transformational impact on its country's transport infrastructure, or a client wants to know how their project's costs measure up against similar projects in the rail sector – the answer can be found in the UK.

Image: Crossrail

Laing O'Rourke – best practice in international rail projects

Playing a major role in many of the world's leading rail projects, Laing O'Rourke delivers services in railway infrastructure, design and construction, trackwork, high speed rail, mass transit systems, depot construction, electrification, signalling, junction renewals, maintenance, and plant and equipment supply.

As part of the Novo Rail Alliance in Australia, the company has delivered rail infrastructure upgrades across metropolitan Sydney for the past five years, and has also helped deliver such projects as the upgrade of Adelaide's urban rail network and construction of the 1,420km Alice to Darwin Springs line.

Laing O'Rourke has been involved in the construction and upgrade of railways across the United Arab Emirates in Saudi Arabia and South East Asia (Hong Kong, Singapore, Thailand and Malaysia) for many years. In Taiwan, Laing O'Rourke's joint venture constructed the track work for the 345km high speed line from Taipei to Kaohsiung. It managed international and Taiwanese contractors, as well as traffic management, logistics, ventilation, lighting, power, tunnel communications and quality control. In Hong Kong, meanwhile, Laing O'Rourke joint ventures are delivering two packages of construction works at the new West Kowloon Station terminus, and have been recognised for its safety performance on those projects. The company is also helping provide infrastructure for Hong Kong's Admiralty Station.

In the UK, the rail industry's first "pure construction alliance" is seeing a collaborative and unified agreement between Network Rail, Laing O'Rourke and two further partners delivering the Stafford Area Improvement Programme on the West Coast Main Line. The model is a move away from traditional "hub and spoke" contracts towards an integrated "one team" structure where all parties share benefits and risks, and widely regarded as the ideal format for future projects. The company has also helped deliver the redevelopment of St Pancras, King's Cross, and Farringdon stations, and is now delivering Crossrail stations at Liverpool Street, Bond Street, Tottenham Court Road, Custom House and Canary Wharf, as well as new depot facilities for Transport for London at Willesden.

Laing O'Rourke's best practice approach across these projects includes modularisation and offsite fabrication, which means components can be made in a controlled factory environment, saving time, improving safety and resulting in high-quality installations. It is also using digital engineering to overcome potential design challenges and ensure up-to-date and intelligent data at handover.

www.laingorourke.com

Atkins – expanding Hong Kong's rail network

With a long history in Hong Kong, Atkins is working with operator MTR Corporation on the vital expansion of the metro network on two key lines: the West Island Line and the Express Rail Link.

Atkins has played a pivotal role that includes the analysis, design and detailing of tunnel internal works on these complex projects, which had to be designed under a fast-track programme. This called for all Atkins' technical skill, along with effective collaboration between the company, its partners, sub-consultants and the MTR Corporation to deliver the projects on time and to a very high design standard.

The design of urban rock caverns, overcoming challenges such as soft ground excavation through densely populated areas and deep rock tunnels beneath the highest mountains in Hong Kong, has made these projects an international technical showcase for the tunnelling sector.

Expansion of Hong Kong's rail network is driven by an increase in population and business. Both these strategically important projects will contribute to making Hong Kong accessible and successful, providing long-term benefits to the economy in one of the world's premier business centres.

www.atkinsglobal.com

John McAslan + Partners – transforming King's Cross Station

The transformation of King's Cross Station has been a complex, multi-phased project, with John McAslan + Partners as lead architects and master planners.

The historic train shed and range buildings have been adapted and re-used, the station's previously obscured Grade I listed facade has been restored, and the new Western Concourse is now the centrepiece and the "beating heart" of the project.

The brief included converting Victorian sub-platform vaults to contain new servicing systems; creating a new decant platform, requiring a 200m excavation under the Eastern Range; upgrading all other platforms, and a new glazed bridge spanning the tracks in the main train shed.

The project's most significant design and engineering challenge was the creation of the new 7,500 sq metres concourse which, measuring 120m wide by 20m high, is triple the size of its predecessor. The simultaneous construction of London Underground's concourses and ticket halls beneath the new concourse meant that its structural supports were designed to direct forces away from the foundations of the Grade I listed Western Range building and Great Northern Hotel.

The redevelopment of King's Cross Station creates a dialogue between Cubitt's original design and 21st-century architecture, resulting in an iconic architectural gateway to the capital.

www.mcaslan.co.uk

Image: John McAslan

Clyde & Co – Simandou project Trans-Guinean railway

Clyde & Co is a global law firm with more than 1,400 lawyers operating from 33 offices and associated offices across six continents. The firm has a keen focus on the rail sector and acts as an adviser for those who want to operate in the rapidly expanding rail markets.

The firm is advising the Guinean Government on the high-profile Simandou South iron ore mining project developed in partnership with Rio Tinto, Chalco and the International Finance Corporation – a member of the World Bank.

The $20 billion project involves one of the world's largest untapped high-quality iron ore deposits, located in the south-east of Guinea, and includes the construction of a trans-Guinean railway and the development of a deep water port to the south of Conakry, Guinea's capital.

The complex, 670km multi-user railway to take iron ore from the Simandou concessions will include two viaducts, 24km of tunnels and 29 bridges, and is expected to help open up the heavily populated hinterland. In addition to allowing freight movements to enable the iron ore to be exported, the railway will facilitate passenger services as well as the movement of other freight.

Once completed, it is set to be the largest integrated iron ore mine and infrastructure project ever developed in Africa, offering the potential to transform the country's economy and transport infrastructure.

Clyde & Co has a long heritage in supporting integrated natural resource projects, particularly in Africa, and has advised on a number of mining and infrastructure projects including the Tonkilli project in Sierra Leone.

www.clydeco.com

Mott MacDonald – BIM innovation on the Victoria Station Upgrade Project

Mott MacDonald developed the concept design for the Victoria Station Upgrade Project and is now project designer for Taylor Woodrow-BAM Nuttall (TWBN), the joint venture contractor delivering the project.

The upgrade is an example of innovation leading to a more sustainable design for a major infrastructure scheme. In this case, complex construction work is being done while the underground station is kept fully operational in a congested urban environment.

This work has included constructing tunnels at shallow depths, mainly in wet gravel where the technique of "jet grouting" is being used to stabilise the ground and keep out groundwater; this has involved installing 2,122 jet grout columns.

Building information modelling (BIM) by Mott MacDonald produced data that enabled the jet grout rigs to be accurately positioned. The Victoria Station Upgrade subsequently scooped the BIM Project Application Award at the 2012 British Construction Industry Awards (BCIA) in recognition of its innovative use of BIM.

Mott MacDonald's BIM expertise has also been put to use by its teams in Kuala Lumpur, Asia Pacific, Europe, the Middle East and UK. Two other projects to which Mott MacDonald has contributed, the Hong Kong International Airport midfield concourse and the Toronto-York Spadina subway extension twin tunnels, have also picked up honours in the Bentley Systems global BIM Awards.

The company is also leading on station design and sustainability on New Zealand's first underground railway, the NZ$2.86 billion Auckland City Rail Link.

www.mottmac.com

Arup – high speed experience

Arup's rail experience covers all forms of guided transport systems and associated facilities, including intercity rail, urban rail and freight.

The company created an alternative to the Government's initial HS1 route, to avoid demolishing property, enable regeneration of run-down areas, provide a faster, more direct route, and offer additional fast commuter services to London.

This route was subsequently adopted, and Arup then became a founding member of LCR, the company formed to finance and deliver the project. In fact, Arup's 18-year involvement in the project included the routing, economic viability, design and delivery of this 108km, 300kph railway. It led the majority of the engineering disciplines and environmental work through the preliminary and detailed design phase, and assisted in the successful project management and delivery of the project, involving more than 1,600 Arup staff.

In 2009 Arup – which had undertaken a concept study of routes to the north of London in 2001 – was appointed to investigate and develop options for the HS2 route, connecting London to the north of England and Scotland.

The company looked at solutions for a 400kph high speed line from London to Birmingham, including options for stations in London and Birmingham; access to Heathrow Airport and possible connections to HS1.

Subsequently, Arup carried out route options studies for an extension of the network to the north-east, incorporating stations to serve Nottingham/Derby, Sheffield, and Leeds.

Following the Government's decision to go ahead in 2012, Arup was appointed engineering designer for the London terminus at Euston; engineering designer for the route through the West Midlands including two stations and the depot; the environmental overseeing consultant for the whole route; environmental impact assessment consultant for the West Midlands section; and for specialist services including noise simulation and tunnel aerodynamics.

www.arup.com

Image ARUP

JSA Architecture – design for Dublin Metro North

JSA Architecture Limited is an award-winning consultancy specialising in transport architecture and master planning. JSA has wide international experience of the design of underground, elevated and at-grade stations. Other work in the sector includes urban design, depots and associated commercial property developments.

JSA works at all stages of projects from feasibility studies, concept and detailed design, through to the provision of construction support during on-site operations. JSA is frequently appointed as specialist rail architects by major engineering consultancies and contractors.

JSA also provides consultancy services to railway authorities, giving expert advice on architecture and urban design, including the development of design standards and guidelines. Leading clients in the European rail sector include Transport for London, Network Rail, Swedish Transport Administration and Irish Rail. In the Middle East and Asia, JSA has worked for Qatar Rail, Dubai Roads and Transport Authority, Singapore Land Transport Authority (MRT) and the Hong Kong MTR Corporation.

Dublin Metro North is a proposed metro line crossing through Dublin, extending 16.5km from the city centre at St Stephen's Green in the south, to Dublin Airport in the north. It will consist of some 17 stations, of which nine will be underground. JSA was a key adviser to the project, acting as chief architect for the Irish Government's Railway Procurement Agency, and was involved in designing six major city-centre underground stations, as well as having other key responsibilities on the project.

www.jsaarchitecture.com

Kier Group plc – constructing Admiralty Station in Hong Kong

Kier Group plc is a leading construction, services and property group active in the UK, Eastern Europe, the Middle East and Asia Pacific regions.

In rail, Kier provides multi-disciplinary project management and construction services and has been responsible for some significant projects, including the channel tunnel rail link and the award-winning KCRC Mei Foo rail station in Hong Kong. Recent rail projects include Crossrail tunnelling in London, the Hong Kong Express Rail Link and the extension of Hong Kong's Admiralty station.

Under a £200 million, four-year contract, Kier is extending the existing Admiralty Station to provide interchange facilities between the existing Tsuen Wan Line and Island Line, the new South Island Line and the Shatin to Central Link. These works to one of the busiest stations in Hong Kong are progressing without affecting the existing, continuing operation. As well as the four new platforms under construction below and adjacent to the existing station, the works include an interchange concourse, relocating existing passenger entrances and external landscaping.

The project is in the central business district on Hong Kong Island, a complex working environment with considerable constraints in terms of access, traffic and noise. Work is being carried out on multiple fronts in a congested site surrounded by skyscrapers, major highways and the existing MTR underground lines. These daily challenges to the site team call for detailed planning and organisation to keep the site moving.

www.kier.co.uk

Turner & Townsend – consultants bringing global best practice to rail tunnelling in three continents

Turner & Townsend is an independent construction and project management consultancy with a truly global footprint. For years the company, formed in the UK in 1946, has captured intelligent data from projects around the world to enhance new rail projects.

The company uses data gathered on major projects to produce a global benchmarking database for project costs, bringing together cost information from several sectors. In the rail sector the company has completed sub-sector data benchmarking sets for light rail, metro, freight, high speed and conventional rail projects – against which clients can measure their own projects.

This approach not only helps projects in mature markets with sophisticated supply chains, but also those where the scale of infrastructure projects outstrips in-country experience and knowledge.

Turner & Townsend is helping deliver three globally significant rail tunnelling projects, bringing expertise in cost estimating, procurement and cost management systems to London Crossrail, Doha Metro – which will be one of the largest urban metro systems in the Middle East, and Sydney's $8.3 billion North West Rail link.

Not only has Turner & Townsend implemented cost management best practice on such projects – where its global benchmark databases have proven invaluable – but the company has also enhanced projects with its knowledge and best practice on risk, project controls, programme management and procurement.

The consultancy's in-depth knowledge of international construction contracts has provided insight that's helping to meet client objectives in an increasingly global field of competitors.

www.turnerandtownsend.com

Weston Williamson – design for Klang Valley Stations

Weston Williamson+Partners (WW+P) is an architectural and urban design practice that specialises in transport infrastructure and related urban design projects. Geographically, WW+P works both in the UK and overseas with projects in Boston USA, Dubai, India, Kuala Lumpur and China.

Notable UK rail projects include London Bridge Station for the Jubilee Line Extension, Paddington Station for Crossrail, Pudding Mill Lane for Crossrail, East London Line, DLR extensions to City London Airport and Stratford International, London Victoria Station Upgrade and Dubai Light Railway Transit. In 2010 WW+P was appointed architect for 14 stations on the elevated section of the blue line of the Klang Valley MRT in Kuala Lumpur, designing the stations and helping integrate them with a complex urban setting. This was done alongside URS and Aecom to interpret passenger numbers and plan the stations to provide best value.

Two years later, the company was appointed as an architectural design lead working with the design consultants (AECOM/Mott MacDonald) on the UG1 and UG2 sections of the first Klang Valley MRT line – the MRT Sungai Buloh-Kajang Line. The scope of work involves streamlining the interpretation of the architectural station design between these two underground sections, which consist of seven stations and ancillary buildings. This includes resolving technical interface and integration issues, and standardising the design and finishes with recommended access and maintenance strategies.

www.westonwilliamson.com

Steer Davies Gleave – delivering the right transit solution

Across the world, towns and cities looking to support economic growth, promote regeneration, address social inequality and tackle problems of congestion are turning to the idea of new or improved transit lines.

But their investment costs are significant, so the choice of which mode of transport – bus rapid transit, light rail, metro or suburban rail – and which route to develop are critical for meeting objectives and securing value.

Spatial planning policies, urban form, city size, cultural factors and economic profile all influence travel patterns and therefore the specification of transit systems. Steer Davies Gleave has built an international reputation for developing innovative, integrated and deliverable solutions that help clients through every stage needed to reach the right urban transit solution.

In Puerto Rico, the company is working with the country's government to develop ridership and revenue forecasts for a new commuter rail route to the capital San Juan.

In Dublin, it was instrumental in specifying the role of LUAS – Dublin's light rail system – in Dublin's transport system, route planning and then the process of securing funding from the Irish Government and European Union.

In Delhi, Steer Davies Gleave supported the development of India's first rail-based express airport link – which will connect India's largest airport, the newly privatised Indira Gandhi International Airport, with the city centre.

Meanwhile, the London Underground's Northern Line Extension to Battersea will open up a swathe of south-west London for redevelopment. Steer Davies Gleave has led integration of this scheme with development plans and the scheme's benefit cost assessment.

www.steerdaviesgleave.com

WSP – Stockholm's largest construction project

WSP is a leading professional services consultancy with more than 60 years' experience in rail project delivery, and 5,000 transportation and infrastructure professionals employed worldwide. The company has delivered major rail projects across the world, from huge and intricate underground lines in Stockholm and high speed rail concepts in Norway, to planning rapid light rail systems in the Caribbean and redeveloping landmark stations in London.

The City Line is Stockholm's largest construction project, involving the drilling and safe blasting of a 6km rail tunnel under central Stockholm and the construction of two new stations. WSP is responsible for delivering the largest and most complex part of the project, providing a range of multidisciplinary services including tender documents, detailed design, project management and technical support during construction. Its three contracts cover about 2km of the line – the Norrmalm Tunnel, Norrström Tunnel and City Station.

Linking the City Station with the existing blue metro line involved blasting a connection tunnel through an area of bedrock that measured just 3m across, within a fixed four-month window. The complexity of the project required WSP to apply its market-leading expertise in the latest building information modelling (BIM) tools. The number of tunnels, all going in different directions, could not be drawn in 2D, so 3D CAD was used to get the correct design. Then, all the geotechnical surveys, rock surveys and other information were added to the model, and it was used for collaboration between the various technical teams working on the project.

The project's geotechnical models are the most complex ever run in Sweden.

www.wspgroup.co.uk

02 Rail infrastructure and equipment

Features

30 ASL
31 Camlin Rail
31 DeltaRail
32 Pandrol
33 GEOfabrics
34 Thales UK
34 Hawker Siddeley Switchgear
35 TRE
35 Tata Steel
36 Mechan

Image: Network Rail

Rail infrastructure and equipment

The UK rail industry supports a strong supply chain that delivers proven and new solutions to rail clients in the UK and internationally.

A broad range of UK companies – from small independents to large, international OEMs – supply products and services across permanent way, power and electrification, signalling control and communications, stations and depots.

Recognised for the high quality and performance of their products and services, many of the UK's infrastructure and equipment suppliers are world leaders, with capabilities ranging from the provision of niche technologies to high-volume heavy manufacturing.

Attracted by the ongoing investment in UK rail, new companies continue to enter the market – bringing new competition and innovation from other sectors. Overseas companies have also looked to invest in UK-based rail suppliers, recognising the value of their capabilities.

The UK is also home to companies such as Unipart Rail, which can help clients innovate to create real firsts in technologies and services, as well as bringing new efficiencies to their supply chains.

In permanent way, UK companies export a diverse range of products that includes ballast stabilisation and drainage, track, switches and crossings, rail fastenings, lightweight cable troughing, and friction management solutions as well as track plant and maintenance equipment.

They also provide the full spectrum of power and electrification products and services, including overhead line and catenary, third rail and traction power systems.

In signalling control and communications, there's a significant body of UK-based manufacturing and intellectual capital across large OEMs and smaller specialist companies. Siemens Rail Automation, a global leader in the design, supply, installation and commissioning of trackside and train-borne signalling and train control solutions, has more than 140 years' experience in the UK – including in earlier incarnations as Invensys and Westinghouse Rail Systems.

Other UK-based signalling expertise encompasses both train control systems and wayside signalling, along with strong capabilities in signalling design and installation. UK companies continue to develop and deliver new uses of technology in signalling control and communications – such as Deltarail's flagship control technology, IECC Scalable.

The UK's offer in stations and depots spans from architectural and building products to station control systems, to train handling, maintenance and safety equipment.

Today, many international rail suppliers draw on UK-based expertise and capabilities to deliver products and services to rail customers around the world.

ASL – tailored station management solutions

Application Solutions (ASL) manufactures public address and voice alarm equipment for use on railways all over the world, while its iVENCS software is also making a huge difference to station control rooms, combining numerous systems into one intuitive 3D environment.

ASL has equipment installed around the globe for long line public address over IP applications, including in Canada, South Africa, UK, Norway, the UAE and India – and is presently involved in such projects as the Kelana Jaya Line Extension, Crossrail and Hyderabad.

Norwegian Rail, with ASL's local partners Innotronic, has installed the iPAM solution across 400 stations with control software. In 2009, ASL was initially awarded the £1.2 million contract for the 283-station-monitored long line PA system for the country's national rail administrator Jernbaneverke, but roll-out has continued beyond that. Crucial factors in winning that contract included the ability of ASL's solution to integrate with the client's passenger information management system, as well as being able to deliver a 20-year support framework centred on the use of open technologies.

Some of the stations are above the Arctic Circle and extremely remote with minimal staffing, so ASL redesigned microphones on the ambient noise sensors to cope with temperatures as low as -50°C. Meanwhile, passengers can replay the last announcement at the touch of a button thanks to extra functionality on the 2U rack mount iPA400 VoIP router and amplifier units. There's also the facility for each unit to bring together control room and monitoring data from other vendors' station equipment, under the supervision of the iVENCS 3D station management software.

ASL's ability to tailor solutions for customer needs in varying environments around the world – coupled with reliability and the latest IP technology – has made the company a world force in this market.

www.asl-control.co.uk

Image: Network Rail

Camlin Rail – ensuring signalling power supply

Camlin Rail, part of the Camlin Group, has been working in partnership with Network Rail for more than ten years, delivering clever products to solve complex problems.

The Camlin Group is a privately owned holding company with a distinguished 30-year history in the global utility and rail sectors. Its headquarters are in Lisburn, Northern Ireland, with engineering and customer support facilities located around the world.

The West Coast Main Line, owned and managed by Network Rail, is the busiest route in the UK, connecting London to Glasgow and carrying more than 30 million passengers annually. Network Rail recognised a signalling power failure on this part of the network would cause severe disruption leading to long delays for rail passengers and incur significant financial penalties for Network Rail.

An automated system was needed to re-configure the signalling power network in the event of a power supply failure, cable fault or cable theft and eliminate the possibility of a train delay. Camlin Rail came up with the cost-effective solution of using SIGNET, a fully automated power system consisting of state-of-the-art vacuum technology with microprocessor control.

More than 700 SIGNETS are installed and operating on the West Coast Main Line, spanning over 150 miles of track, ensuring power is continuously delivered to the signalling systems. SIGNET has performed thousands of successful operations over the last ten years, with last year's operations alone saving Network Rail £10 million in potential delay minutes.

Camlin Rail also specialises in fault location and online circuit breaker testing with bespoke products for portable and fixed applications.

www.camlinrail.com

DeltaRail – deploying revolutionary control technology

DeltaRail is the largest supplier of signalling control systems in the UK, and the first to introduce next-generation IT architecture built upon a flexible Message Broker communications platform.

DeltaRail's systems scale to manage busy, complex parts of the network, controlling in excess of 2,400 trains per day, through to low-density rural areas with only 70 trains per day. The technology helps to significantly lower maintenance and lifecycle costs, and provides a cost-effective modular approach to traffic management. What's more, an agnostic approach to interlocking avoids such issues as "vendor lock-in", enabling cost-effective re-control of existing, brownfield routes as well as the competitive tendering of signalling works while ensuring a common user interface.

In 2012, Network Rail began deploying DeltaRail's revolutionary new control technology, IECC Scalable. Resulting in lower costs, fewer delays and reduced signaller workload. The new system also delivers a range of traffic management tools and interfaces with existing legacy systems. Network Rail has since procured another 14 systems including more than 20 workstations. DeltaRail is continuing to develop its traffic management solution that builds on the IECC Scalable architecture.

The company also supplies operational control software for crew rostering and depot management, as well as asset management products to automate inspection of rolling stock and track.

www.deltarail.com

Pandrol – world leader in rail fastenings

Pandrol is a technological innovator in the rail industry and a leader in the world rail fastenings business. It has been in business for more than 75 years, thanks to ongoing investment in its R&D facilities and the reach of its global operations. Its products are regularly sold on every continent in the world.

Pandrol has built its recent success on combining low-maintenance threadless technology with high output mechanised equipment. The Pandrol FASTCLIP "switch-on/switch-off" rail fastening system, for example, can be applied at the impressive rate of 70 sleepers per minute using Rosenqvist CD 500 clipping equipment.

Already leading in conventional ballasted tracks, Pandrol also supplies rail fastening technology for slab track on light rail, metro and high speed systems. A number of projects in major cities such as Kuala Lumpur, Singapore, Bangkok, Hong Kong, Kolkata and on the Golden Horn bridge in Istanbul have installed Pandrol systems on their slab track. High speed trains in China, Korea and Japan are already running at up to 350km per hour on slab tracks with Pandrol fastenings. Pandrol has developed special rail fastening systems for reducing vibration and noise. These include Pandrol Vanguard, which can often be retrofitted into vibration-sensitive areas on existing metros. The company delivered thousands of tailored Vanguard baseplates to Beijing Metro in China just prior to the 2008 Beijing Olympic Games, to mitigate ground vibration from the subway system. Pandrol Vanguard has also been supplied for new-build projects in more than 20 major cities throughout the world, including London, Madrid, Milan, Boston, Barcelona, Oslo, Shanghai and Belgrade.

www.pandrol.com

Image: UKTI

GEOfabrics – geocomposite enhancing ballast performance

GEOfabrics Limited is a specialist manufacturer of high-quality and performance-orientated geotextiles and geocomposite ground engineering solutions. These products are installed underneath the ballast and above the subgrade in permanent way rail infrastructure, to provide reinforcement, drainage and filtration.

The GEOfabrics portfolio includes Tracktex, a patented composite solution designed to stop fine-grained subgrade particles, such as clays, being pumped into the ballast. This causes vertical/lateral rail deflection and subsidence, which means expensive remediation and high levels of risk associated with train speed restrictions and derailment.

Tracktex has been developed in partnership with Network Rail over the past ten years and is a proven solution when treating poor ground conditions, used in sites across the network over many years.

Some of its key benefits include replacement of traditional granular sand blinding layer, saving on construction costs; earthworks or excavation kept to a minimum; and installation that's twice as quick as traditional granular layers. Another key advantage of the product is the resulting extended maintenance intervals, which in turn mean reduced long-term costs.

The system is currently being expanded into Europe, North America, Middle East, Australia and Asia.

www.geofabrics.com

Image: UKTI

Hawker Siddeley Switchgear – Fit & Forget technology extends the maintenance boundary

As a major national and international manufacturer of indoor and outdoor medium voltage distribution, marine and transit switchgear, Hawker Siddeley Switchgear Ltd (HSS) serves electrical utilities, industrial, commercial and transit sectors worldwide.

Committed to research and development, HSS's latest range of switchgear uses the manufacturer's Fit & Forget technology, which moves life expectancy of products from 2,000 to 10,000 operations and beyond.

The latest addition to the range is HSS's Lightning product, which incorporates the high speed NDC Circuit Breaker and uses patented magnetic actuator technology. Network Rail has seen the benefits of the product, awarding HSS with a multi-million-pound contract to install more than 250 Lightning NDC panels.

Representing a safe, cost-effective and low-maintenance switchgear solution for modern railway tracks, it boosts track performance and reliability.

Hawker Siddeley Switchgear also boasts a worldwide presence with equipment installed in many prestigious transit systems, including in Dubai, Guangzhou, Mumbai and the New York Metro.

www.hss-ltd.com

Thales UK – international OEM draws on UK expertise

Thales has vast experience in worldwide transportation markets as well as serving the security, defence and aerospace sectors. Transport networks around the world rely on Thales technology and services to improve safety and reliability and optmise capacity.

Thales' UK-based solutions range from standalone products such as signalling (train control, axle counters, interlockings, train protection warning systems, services), to integrated products such as supervision and control, integrated communications, security and information management. UK clients include Transport for London, Network Rail, London Underground, DLR, Greater Manchester Passenger Transport Executive and numerous train operating companies.

Signalling systems and communications networks installed and managed by Thales played their part in transporting record numbers of passengers during the London 2012 Olympic and Paralympic Games. Passenger numbers for London Underground were up 30 percent, with 60 million journeys made during the Games. The Jubilee line, which uses the SelTrac signalling system from Thales, safely transported millions of people throughout the Olympics – including a peak performance on three successive days when zero delays were recorded.

Thales UK is one of three organisations selected to demonstrate how advanced traffic management technology (TMS) can be used across the UK rail network to improve performance and capacity. The Thales ARAMIS Traffic management Solution is already delivering benefit in 11 countries, while the company has successfully completed the prototype phase as part of Network Rail's plans to develop a new traffic management system.

www.thalesgroup.com

Tata Steel – high-performance rail for demanding applications

Tata Steel has a long tradition of rail manufacturing in the UK, and works to maintain this with its commitment to developing world-class rail products and manufacturing processes.

Its £130 million investment in the rail manufacturing plant at Scunthorpe allows for production of long length high-quality rail. This has allowed the company to produce rails up to 108m, with potential for 120m long – equalling the longest in the world – and weld of up to 216m strings.

Developing such products as HPrail, SilentTrack and Railcote, Tata Steel works closely with customers to create products that directly address their needs. Its rail technology specialists offer a depth of knowledge to help improve operational efficiency and network integrity, while world-class on-site laboratory facilities mean detailed materials and product testing can be conducted on customers' behalf.

HPrail is designed to be predominantly used on curved track and other high-duty areas where rolling contact fatigue and wear are the issue. The reduced grinding frequency, compared to standard grade rails, means longer rail life and lower lifecycle costs.

SilentTrack, meanwhile, uses sound absorbers on the rail web and upper part of the foot to reduce noise, cutting out the need for expensive noise-abatement walls alongside the tracks. Railcote is designed to be used in areas of track experiencing corrosion, such as level crossings, tunnels, coastal tracks and areas prone to stray currents. Railcote provides a more robust coating and sacrificial protection so it continues to work even if the coating is damaged.

www.tatasteelrail.com

TRE – signalling simulation for Norwegian Rail

TRE rail is a leading innovator in the supply of dedicated products and services designed to improve the supervision and control of railways worldwide.

TRE, along with local and regional partners, implemented a full-fidelity signalling simulator as part of the advanced training facility at Norsk Jernbane Skole (NJSK, the Norwegian Railway School), a purpose-built training centre near Oslo.

NJSK is thought to be the most advanced railway training academy in Europe and is unique in offering integrated dispatcher and driver training. The "full-fidelity" simulator, which completely emulates a system, enables three dispatchers and six drivers to interact on an accurate representation of the railway around Oslo Central, the busiest area on the Norwegian network. This allows dispatchers to train on an accurate representation of the traffic management system while drivers react to accurate simulations of real-world conditions.Jernbaneverket, the Norwegian National Rail Administration, believes in this integrated approach as a way for train dispatchers and drivers to learn as a team and foster an understanding of the unique pressures each is under. It also significantly contributes to service performance and emergency recovery.

The TRE system (TREsim) uses multiple OEM interlocking data, geographical features, track lengths, train performance characteristics and real timetable information to produce such full-fidelity simulation.

www.trerail.co.uk

Mechan – delivering the UK's largest rail traverser

Mechan has more than 40 years' experience in the design, development and production of specialist heavy lifting and handling products for the rail industry.

Equipment produced by the Sheffield-based manufacturer can be found in the world's most prestigious maintenance depots and thanks to its innovative team, the firm has established an international reputation for quality, safety and reliability.

Mechan recently secured its place in the transport industry's record books, after installing the largest capacity rail traverser in the UK at the Port of Felixstowe's new North Rail Terminal.

The structure is used to move freight locomotives between lines and is the most advanced traverser ever produced by Mechan. Weighing 90 tonnes and measuring 30m in length, the behemoth was designed specifically to carry up to 170 tonnes, as future locomotives are expected to be larger than today's. It took almost 12 months to build and was delivered complete to site.

www.mechan.co.uk

Image: Network Rail

03 Rolling stock

Features

40 Bombardier
40 Brecknell Willis
41 Hitachi
42 Creactive Design
42 David Brown
43 Alstom
43 Rowe Hankins
44 Interfleet
44 Pickersgill-Kaye
45 Siemens
45 Ultra Global PRT
46 Unipart Rail
46 Rail Interiors Solutions

Image: Bombardier

Rolling stock

Traditionally a major exporter of rolling stock, the skills and expertise which Britain offers in this field are set to get a major boost with the introduction of new manufacturing capability. And the UK already has a lot to offer the international market in terms of rolling stock capability.

Bombardier manufactures trains in the UK and supports a significant supply chain of UK businesses. In the UK it is focused on the domestic market, and recently won a high-profile contract to provide trains for the London Crossrail project. However, the company has also previously provided UK-built trains to the Gautrain project in South Africa.

In a huge vote of confidence in UK export potential, Hitachi has announced it is to base the headquarters of its global rail business in the UK as part of the accelerated globalisation of its rail systems business. The company is already building a rolling stock manufacturing facility in the UK with a view to serving the wider European market.

The UK also offers a broad range of rolling stock products and services. This includes the manufacture and supply of components, vehicle design and engineering services (both chassis and interiors), management and maintenance of rolling stock assets, condition monitoring, retrofit and upgrade services, train financing and leasing, engineering and train driver training solutions and approvals support to introduce new rolling stock assets to the system.

What's more, the UK is leading in number of areas on innovation and research and development. UK organisations are involved in developing solutions in a range of areas including train propulsion, low-energy systems, the application of composite materials, vehicle design and condition monitoring.

Some of these capabilities are highlighted in this section and in the sections covering asset management services, innovation, training and academia and research.

Image: Crossrail

Bombardier in the UK

Bombardier has a UK workforce of more than 3,500 people and a presence at 31 locations. The company has built, or has on order, around 60 percent of the UK's rolling stock and is contracted to service around a third of the UK fleet.

Recently, Bombardier won the contract to deliver rolling stock and a new depot for Crossrail, a decision the company sees as a resounding endorsement of the Aventra electric multiple unit (EMU), the train it proposes for the new line.

Its award-winning Electrostar is already the most successful post-privatisation EMU in the UK, with more than 2,500 vehicles entering service in the past decade. The Gautrain Rapid Rail Link, a brand new rail system in South Africa, also operates Bombardier Electrostar trains. However, the Aventra is Bombardier's latest product platform for the UK. Designed both for metro-type and longer distance applications, they are more energy efficient, bringing passengers the latest train technology.

The Cross Country and West Coast networks run Bombardier Voyager and Super Voyager diesel-electric multiple units (DEMUs). Bombardier Meridian DEMUs are also in daily passenger service with UK operator East Midlands Trains, and Bombardier's Turbostar diesel multiple-units are in service with many operators.

Meanwhile, Bombardier Flexity 2 trams, which have been in successful revenue service in Blackpool since April 2012, incorporate the "best of the best" global tram technology.

Among the fleets for which Bombardier has total fleet management responsibility are the diesel-electric trains operated by Arriva CrossCountry and Virgin West Coast, maintained at a purpose-built facility, Central Rivers, and a number of overnight out-station depots. Bombardier fleets throughout the UK are supported by highly skilled maintenance teams and by Orbita, a leading-edge predictive maintenance capability.

Bombardier Movia metro trains are making a vast difference on the Victoria and sub-surface lines in London, offering increased capacity and improving reliability.

www.bombardier.com/en/transportation

Brecknell Willis – developing a new pantograph

Brecknell Willis & Co manufactures current collection equipment that's used worldwide on all voltages and systems. The company was involved in a recent project that demonstrated the joint benefits of close co-operation between pantograph manufacturer, train builder and operator to achieve a common goal.

A direct result of London Midland's demand for better pantograph performance to achieve higher service speeds in multiple operation, the Brecknell Willis HSP Mk2 pantograph project called for a radical rethink of panhead design. Along with a series of other minor developments, the result was a dramatic improvement to current collection quality, and more benefits are anticipated in the form of increased contact strip life and reduced pantograph maintenance.

Thanks to the new 30 percent lighter panhead, the wire interface forces generated during accelerations – due to the progressively disturbed wire – were reduced. This lessened the impact energy between the pantograph carbon and the overhead line equipment – and the consequential risk of disconnection. The resulting pantograph still has the majority of components and functionality of the existing proven reliable current collection system.

Instrumented tests were carried out on the main line to demonstrate that stated goals had been achieved to the satisfaction of the infrastructure owners, vehicle designers and service operators. The pantograph is now also destined for the new Thameslink vehicles.

www.brecknellwillis.com

Hitachi – establishing new UK rolling stock manufacturing capability

Hitachi Rail Europe Ltd is a wholly owned subsidiary of Hitachi Europe, Ltd and headquartered in London, UK. As a total railway system supplier, the company offers rolling stock, traction equipment, signalling solutions, traffic management systems, and maintenance depots.

Hitachi draws on many years of experience as a leading supplier of metro, commuter and high speed trains such as the Shinkansen (bullet train) for the Japanese and international markets. In Europe, Hitachi Rail Europe delivered the fleet of 29 Class 395 Javelin trains, the first domestic high speed train in the UK, maintained at Hitachi's depot in Ashford, Kent.

As part of the Department for Transport's Intercity Express Programme, Agility Trains – of which Hitachi Rail Europe is the main shareholder – will finance and deliver a fleet of 122 Class 800/801 trains for the Great Western Main Line and the East Coast Main Line. Hitachi Rail Europe has been tasked with manufacturing the trains and maintaining them over a period of 27.5 years.

To fulfill this and future contracts, Hitachi Rail Europe has decided to invest in a state-of-the-art train manufacturing plant and has chosen Newton Aycliffe, County Durham as the location of the £82 million facility.

The construction phase for the factory has started and is set to conclude mid-2015. Once operational, 730 people will be employed at the plant, which includes a test track and an R&D facility.

Hitachi's substantial investment in a new train facility signals a new phase in its commitment to the British rail industry, and heralded the company's recent decision to base the headquarters of its global rail business in the UK.

Hitachi is keen to fill its order books, building trains in the UK – for use in Britain and for exporting to continental Europe.

www.hitachirail-eu.com

Image: Hitachi

Creactive Design – better trains, fresh thinking

Design and engineering consultancy Creactive draws on a raft of rail experience to make sure that passengers – and the company's world-class clients – are all sitting comfortably.

The Warwick-based company's team of designers and engineers have skills that extend from light rail and heavy rail rolling stock to railway vehicle design, carriage interiors and exteriors, through to station infrastructure.

Creactive's trains and transport solutions begin with the opinions of consumers, using research and focus groups to make sure its designs will meet the needs of users.

For MTR's West Rail metro trains in Hong Kong, the company worked with the Japanese manufacturer IKK (Itochu, Kawasaki and Kinki Sharyo) to define a sleek and engaging design for trains that can comfortably accommodate thousands of passengers using the service during rush hour.

With an experienced eye on the small but crucial details such as seat design, grab rails, intuitive spaces and safe-stepping distances between doors, Creactive is proud of an approach that's driven by its knowledge of customer needs to come up with enduring and attractive solutions.

Creactive has helped Iarnród Éireann (Irish Rail) deliver the Class 22000 fleet, which has transformed the image of InterCity rail travel in Ireland. Modern, light and welcoming, these are also the first trains in Ireland to achieve European accessibility regulations, making them easier to use for all rail users but particularly customers with reduced mobility. Working on cab design, exterior and interior design, the team has created an attractive and relaxing environment for InterCity passengers.

Creactive prides itself on long-standing relationships with clients including London Underground, Arriva, Chiltern Railways, Itochu, Kinki Sharyo, Kawasaki, Mitsui, Hyundai-Rotem and Hitachi.

www.creactive-design.co.uk

David Brown Gear Systems

David Brown Gear Systems dates to 1860 in Huddersfield, West Yorkshire when its core business was the manufacture of patterns for cast gears. Today the company is a global gear engineering leader with more than one billion hours of rail gearbox service.

From tram and light rail to heavy-duty locomotive applications, David Brown provides an extensive range of geared products and services, which have been developed through customer-focused innovation, as well as historic acquisition of prestige rail brands GEC Alstom Gears, Hygate Transmissions and Maag Italia.

Recently, David Brown was awarded a contract with a leading train and tram supplier to deliver a gearbox prototype for 100 percent low-floor trams, which is both independently driven and can be used as the platform for a new hybrid application. With strict vehicle weight, noise and space restrictions, David Brown's specialist engineers had to work to stringent parameters. This was no problem – more than 150 years of traction gearing experience, as well as proven references in 70 percent and 100 percent low-floor gearboxes, meant David Brown was able to design, manufacture and type test a 100 percent hypoid bevel gearbox at its UK facility.

As well as innovative gear systems, David Brown delivers a full range of service solutions to leading companies such as London Underground Ltd, Alstom Transport, Bombardier Transportation and other rolling stock manufacturers/train operating companies. The company has recently upgraded the internal gears for one of the UK's major train fleets after they were relocated to a new, more efficient network. The gears were modified to enable faster acceleration out of each station, ensuring each train's operation was fast and efficient.

David Brown Gear Systems is a story of industry, engineering and service expertise, with six manufacturing facilities and 18 gearbox service centres across the globe.

www.davidbrown.com

Alstom – Health Hub

Alstom has created a state-of-the-art bespoke "health measurement" system called Health Hub for the Virgin Pendolino fleet that runs on the West Coast Main Line, Europe's busiest train line. The system produces a swathe of information that helps increase fleet life and reduces maintenance downtime.

Health Hub is effectively a "drive through" health scanner for rolling stock that can provide reports for individual trains by using specialist measuring systems that use precision lasers and cameras to acquire profiles of selected components. It can then carry out automated assessments of those components, producing health reports for individual trains based on their wheel measurements and wear, brake integrity and/or thickness, and the integrity of the body, as well as being able to measure pantograph carbon levels.

This information is then delivered to key users in Alstom's skilled maintenance teams, who are able to immediately see the condition of the trains in real-time, something that was not previously possible. The users can then drill down in more detail to any one of the measured components and predict what its remaining useful life will be. Users also get the opportunity to see in-depth 3D images of the component to give them even more information on wear and tear.

As well as providing such real-time information, Health Hub also helps increase the mileage between standard services, improves fleet reliability and availability, and helps reduce lifecycle costs associated with key components, such as wheels.

The highly innovative, industry-leading system is being pioneered at Alstom's Manchester Traincare Centre, having been developed as a research and development project between Alstom in the UK and also in Spain. It is currently still in its trial phase but expected to be rolled out across Alstom's transport business across the world in the near future.

www.alstom.com/uk

Rowe Hankins – all aboard for answer to wheel wear challenge

Rowe Hankins Ltd (RHC) is a specialist distributor of electro-mechanical components, and it designs, engineers and manufactures safety-critical components and solutions for the global rail market.

Based in Greater Manchester, UK, the company's products are distributed worldwide, including to rail projects in Europe, Australia, Russia and the USA.

One solution the company has developed, to overcome the costly – and global – issue of wear at the track-wheel interface, is Intelligent Wheel Flange Lubrication (iWFL), an on-train system that's suitable both for national rail networks and urban tram services.

RHC worked with Metrolink in Manchester to test and develop a dedicated iWFL system for the city centre transport system. Trials have shown that the iWFL system significantly reduces the high-pitched noise pollution at the track-wheel interface and extends the life between wheel face regrinding, from the usual 55,000km to 80,000km. Having been tested on a single vehicle, these benefits would be expected to be multiplied on a full rail service.

The intelligence of the system lies within the iWFL Falcon control unit, which uses GPS to identify specific locations of the vehicle, which then in turn distributes the lubrication – while the radius of track curves is detected with the help of a gyroscope-based tilt sensor, working out a lubricant dispensing strategy dependent on speed and distance. The data is processed and stored in memory so that the on-train unit has a complete plan of the route and can lubricate precisely where it's needed.

The iWFL system can be installed on new rolling stock or be retrofitted to existing vehicles.

www.rowehankins.com

Interfleet – from procurement to wheel know-how

Interfleet's experts provided a wide range of commercial and technical consultancy to support Northern Ireland Railways' (NI Railways) procurement of two new diesel multiple unit (class 3000 and class 4000 DMUs) fleets – as part of NI Railway's ongoing investment in the province's rail system.

Work during the procurement phase ranged from developing commercial and technical specifications for the new trains and their maintenance support, right through to tender evaluation and subsequent award of contracts for manufacture, supply, maintenance support and materials provision to Spanish company CAF. For both fleets, Interfleet provided continuing technical, strategic and commercial support, from concept design through to final service delivery of the trains. Interfleet also supported NI Railways as an independent assessor of the status and risks of the project, attending board meetings, technical and project meetings. In addition, the company provided leadership and guidance to NI Railways and CAF in achieving the complex safety approvals necessary for passenger service.

With 650 railway experts working out of 31 offices in ten countries, Interfleet's knowledge spans the spectrum of the railway system: providing consultancy on rolling stock, infrastructure and railways systems.

Interfleet's specialist rolling stock expertise has also helped resolve ride comfort problems in Hong Kong, where new trains on the KCRC West Rail line were suffering hunting instability following moderate wheel wear. An investigation and on-track testing by Interfleet identified that the radial stiffness of the primary radial arm bush was not to specification. This insight was followed up by dynamic modelling to prove that restoring bush stiffness would resolve the issue.

KCRC retained Interfleet as its independent technical adviser while it worked on maintaining long-term ride stability.

Later, when KCRC needed to look into the potential effects of a soft floating slab track on the Kowloon Southern Link, which passes under a prestigious hotel, Interfleet won the contract to investigate electric multiple units (EMU) ride safety. This led to on-track tests on both West Rail and East Rail, involving bespoke use of Interfleet's instrumented wheelset technology (IWT).

www.interfleet.co.uk

Pickersgill-Kaye – door locks and security systems

Pickersgill-Kaye Ltd has built a solid reputation through the specialist design and manufacture of Kaye's patent door locks and security systems for the rail industry.

The company, which has 150 years' experience in the industry, manufactures external LED train door status indicators, internal and external cab door locks and internal egress and external access devices. These are supplied for new-build trains and retrofit projects.

Pickersgill-Kaye's manufacturing flexibility and commitment, backed up by a focus on providing excellent service, has helped the company win new business against often-tough overseas competitors.

The company's products are used by train companies all over the world. Its customers include rail operators and OEMs such as Siemens, Bombardier, Alstom, Irish Rail, CAF, Jiwon Tech, Rotem, Ocean Eagle and Hitachi.

As well as manufacturing standard products, Pickersgill-Kaye is also able to design and make custom-built equipment, such as the bespoke driver door for the Strasbourg Tram.

www.pkaye.co.uk

Ultra Global PRT – on-demand transport systems

Ultra personal rapid transit (PRT) is a new on-demand transport system for developed or urban environments. It's designed to meet the need for congestion-free, multi-origin, multi-destination public transport.

PRT systems are being actively considered for applications around the world, with developers, local authorities and private companies all keen to take advantage of the benefits this innovative form of transport provides.

Using small, driverless electric vehicles that run on guideways, the lightweight and flexible nature of the system means it can be retrofitted into a broad range of environments, providing transport that's environmentally friendly and operationally efficient.

Conventional forms of public transit call for passengers to collect in groups, wait until a large vehicle with a fixed schedule arrives and travel on a pre-determined route, stopping for more passengers on the way. In contrast, Ultra offers personal transport with no waiting, taking passengers non-stop to their chosen destination.

In 2005, Ultra was chosen to build a pod system at London's Heathrow Airport; since 2011 this has provided more than 1,000 passengers each day with a vital link from the T5 Business Car Park to the terminal. The system complements existing forms of public transport with an on-demand and direct service over a localised area. Commissioned by Heathrow Airport operator BAA, the system was completed at a cost of £30 million, and consists of 21 vehicles, a total of 3.8km of one-way guideway, and three stations – two in the T5 Business Car Park and one at Terminal 5.

Ultra Global Ltd is now the world leader in PRT engineering and operations. Starting the Heathrow pod project largely as a research and development-focused organisation, Ultra has built significant project delivery skills. Successful completion and operation of Heathrow Pod gives Ultra a showcase that in turn provides the opportunity to take the product forward to new projects around the world.

www.ultraglobalprt.com

Siemens – rolling stock maintenance centre of excellence

Siemens sees new technology and innovation as essential to maximising the rail industry's return on investment in expensive assets, and helping to achieve the aims set out in the McNulty report (Sir Roy McNulty's study of rail value for money).

Its UK Innovation Centre leads the deployment of state-of-the-art asset management technologies for Siemens' international rail maintenance business. The UK was selected as a test bed to enable the centre – and Siemens' customers across the globe – to benefit from experience gained from its UK service and maintenance business, which is widely recognised as being leading edge.

At nine depots across the UK (Acton, Ardwick, Crewe, Glasgow Shields, Ilford, Leeds, Northampton, Southampton and York) and with two further depots in construction, Siemens is responsible for the maintenance of more than 1,500 rail carriages for seven different operators (with this fleet size set to almost double over the next five years).

The track-side acoustic monitoring system RailBAM is one development pioneered by the Rail Innovation Centre.

The system – first introduced on the South West Trains network – uses sensitive microphones to "listen" to every individual axle bearing on each train as it passes. It can detect axle defects and deterioration, allowing action to be taken quickly to prevent failures. The system reduces in-service failures, significantly increases maintenance intervals and reduces train down time. In addition, a joint initiative with Network Rail introduced variable stiffness radial arm bushes on all South West Trains Class 444 units. The innovative design, which combines traditional elastomer bushes with a hydraulic system, reduces the force between the wheel and the rail, ensuring better movement on curved track at low speeds. The technology significantly cuts down on track damage, cuts infrastructure costs and provides smoother journeys for passengers.

www.siemens.co.uk

Rail Interiors Solutions – experience on the inside

When it comes to providing first-rate interiors, Scotland boasts some high-profile examples in world-renowned settings – after all, even the US President's Oval Office features fabrics all the way from Scotland.

But Scottish talent for interiors also extends to the global rail interiors market – and five specialist firms who have come together in the shape of Rail Interiors Solutions are providing top quality carriage environments to high-profile sector players including Bombardier, First Great Western, Eurostar and Alstom.

One project illustrating the group's collective strengths involved carriage interior refurbishment for 27 Meridian 222 trains for East Midlands Trains.

Standard Class seating fabrics were supplied by Peebles-based Replin Fabrics, while leather for First Class seats was provided by Glasgow's Andrew Muirhead & Son. Working on site at the customer's depot in Derby, Transcal, the Livingston-based seating specialist, swiftly completed its contribution to each train. The project's focus then switched to the train's surfaces, the specialism of Novograf. The East Kilbride firm provided a durable and easy-to-install product. Meanwhile, hardwearing vestibule matting and linoleums came from Forbo Flooring, a global leader in its field.

The £6 million project was completed in February 2012.

www.railinteriors.com

Unipart Rail – transforming the rolling stock supply chain

Unipart Rail is well known in the UK for its logistics services to the industry, but the company is increasingly raising its profile in the Australian market. Its most successful project there is a joint venture (JV) with United Group Limited (UGL) to manage the maintenance of Sydney Trains' fleet of electric and diesel passenger vehicles for the Sydney and State of New South Wales rail network.

UGL Unipart Rail Services Pty Ltd got underway in January 2012 and has delivered significant cost, operational and efficiency savings to Sydney Trains. Unipart's involvement in the JV is in managing all logistics and supply chain issues and introducing benefits through this outsourced service.

The combination of Unipart Rail's systems, robust processes and supply chain capability aligned with UGL's asset management expertise and experience delivers improved high levels of service.

Supply chain benefits already delivered by UGL Unipart include:

- less than 0.05 percent cars out of service awaiting materials from UGL Unipart
- 99.5 percent over the counter parts availability at maintenance centres for all materials requested
- over 70 percent of materials at maintenance centres presented line-side, avoiding maintenance operatives having to wait for parts at stores.

During the time that UGL and Unipart have been working together, Sydney Trains has seen a significant level of change and a transformational journey across all areas of the business. UGL and Unipart have brought their strengths together to deliver huge improvements to key performance indicators.

Meanwhile, the Unipart Sydney logistics centre supports a distribution network across Australia, New Zealand and the ASEAN region.

www.unipartrail.com

04 Asset management - services, technology, maintenance and renewal

Features

50 Network Rail
50 Atkins
51 Perpetuum
51 London Underground
52 Thales UK
52 Serco
52 Nomad Digital (Nomad Tech)
53 Balfour Beatty
53 Instrumentel
54 Tracsis

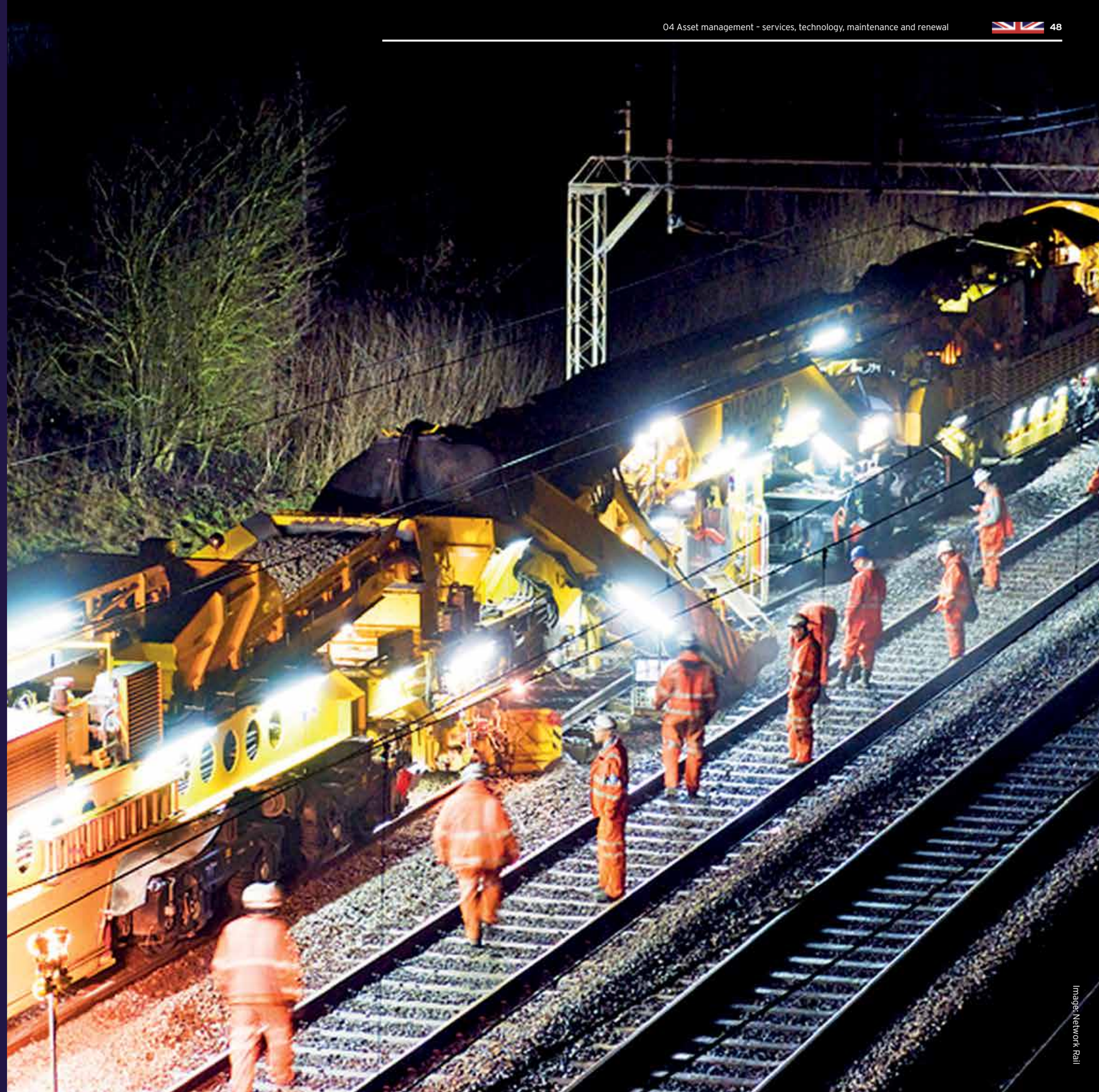


Image: Network Rail

Asset management – services, technology, maintenance and renewal

UK expertise in rail infrastructure asset management is second to none – and it's the UK Standard, PAS 55, that sets the benchmark for modern asset management systems.

Railway and track operators around the world rely on UK know-how to deliver major gains in efficiency and make the most of their expensive assets. Cutting-edge technology and tools are being developed and used by the UK to allow for precision evaluation of the status and condition of infrastructure, rolling stock and individual components.

Maintaining rolling stock and infrastructure in optimum condition impacts positively on several fronts: asset performance, service reliability, passenger and customer experience, and a rail operator's bottom line.

Planning maintenance schedules and overhauls, rather than simply reacting to malfunctions when they arise, reduces in-service failures and the inevitable disruptions these cause.

This approach also cuts costs by extending intervals between services, improving capacity and use of service fleets, and lengthening the life of assets.

The trend is for a preventive and predictive approach to asset management and maintenance to lengthen the lifecycle of assets and increase the time between maintenance levels.

The UK's rail industry and research organisations are leading the way in providing first-class maintenance and monitoring services and developing efficient, effective and easy-to-use predictive and diagnostic tools for infrastructure engineers and train operators.

Image: Network Rail

Network Rail – optimising maintenance interval analysis

Network Rail is a world leader in developing and applying integrated tools and techniques to monitor and manage rail assets.

Within the UK, Network Rail has made marked improvements in its own asset management through an integrated programme addressing an array of enablers. These include improvements to asset data specification and capture, decision support tools, investment in people and their competencies, integrated processes, asset policies, strategic asset management planning, reliability modelling and whole-lifecycle tools which evaluate the trade-off between cost, performance and risk.

Network Rail Consulting is using its knowledge in this sector to help global operators plan, manage and deliver infrastructure that supports current and future maintenance activities efficiently and sustainably.

www.networkrailconsulting.com

Atkins – asset management services for RTA, Dubai

Atkins is one of the world's leading engineering, design and project management consultancies. It has wide-ranging technical expertise and experience in major asset management and monitoring regimes across many industries in the UK and across the world.

Atkins worked interactively with all parts of the Road and Transportation Authority (RTA) to raise understanding and design a tailored blueprint to embed asset management across the full portfolio of transportation assets including structures, roads, metro, buses, boats, and taxis. RTA recognised that managing assets in a safe, optimal and sustainable manner is fundamental for ensuring efficient transportation services, which are vital to the economic development and social wellbeing of the Emirate of Dubai.

Atkins' work considered asset lifecycle, information needs, and performance measurement to set out an overall approach, helping RTA to identify and develop the critical processes tailored to its goals. This enabled it to become the first multimodal transportation service provider in the Middle East to obtain accreditation to the PAS 55 Asset Management Standard.

www.atkinsglobal.com

London Underground – asset management and reliability improvements

London Underground's approach to asset management has played an important role in the gains it has made in reliability. This improvement has been achieved while carrying increasing numbers of customers, running more train services, upgrading vast swathes of the network and keeping some of the oldest trains and signalling in Europe going until they too can be replaced. What's more, London's Underground network presents some unique challenges, with 45 percent of the network in tunnel and access for maintenance work restricted to a few hours in the early morning.

Since 2003, London Underground's reliability has improved significantly and in 2012/13 the network delivered its best ever levels of reliability, of 22.9 million Lost Customer Hours (LCH) while delivering 1,229 million customer journeys – a record number. For reliability, this represents an improvement of more than 40 percent and London Underground is committed to a further 30 percent improvement by 2015. London Underground's approach to asset management spans a range of initiatives to predict and prevent failures, respond more quickly to problems and roll out better equipment.

This includes:

- taking a systematic approach to managing trains, signalling and track
- grouping London Underground's 11 lines into three levels to get the most from their current and planned condition
- a track replacement programme, the delivery of which is critical as track condition underpins the performance of trains and signalling equipment
- installation of remote condition monitoring equipment to a range of signalling equipment including point machines and points heaters, giving an early warning of potential failures
- exploring the feasibility of using wi-fi head-mounted cameras for technical staff, so that live video can be beamed to relevant experts to support faster fault diagnosis and repair on signalling and train faults
- Automatic Track Monitoring System (ATMS), enabling continuous and accurate monitoring of rail condition, and better predictive maintenance, using in-service trains. It is estimated ATMS will save approximately 100,000 LCH per annum
- remotely monitor the trains' systems using the wi-fi network being rolled out.

www.tfl.gov.uk

Perpetuum – monitoring wear in train wheels and bearings

Perpetuum is a leader in wireless condition monitoring for rail applications. Products are based on the company's expertise in understanding and using vibration.

Perpetuum's wireless condition monitoring systems monitor the wear in wheels and bearings on trains. This is done by monitoring vibration and temperature and then using sophisticated algorithms and software to look for the signatures of bearing and wheel wear. The output of this analysis is a simple measure of the health of the wheel or bearing. This allows maintenance to be scheduled when needed rather than on a distance basis so customers can make massive savings in their maintenance costs.

The sensors require no wiring and no batteries are needed as they're equipped with Perpetuum's proprietary energy harvesters that convert the vibration of the train into power. All data is transmitted wirelessly. This allows customers to install the sensor systems with minimal disruption to their services.

Fleets where Perpetuum's wireless condition monitoring is deployed include Southeastern Railway's Electrostar fleet and the Gatwick Express operated by Southern Railway. The technology is being extended to encompass gearboxes and traction motors as part of the Future Railway programme in co-operation with a number of UK train operators.

www.perpetuum.com/rail

Thales UK – delivering the Intelligent Infrastructure Programme

The Intelligent Infrastructure Programme (IIP), delivered in partnership between Network Rail and Thales UK, was highly commended in the Innovation of the Year Award category at the prestigious National Rail Awards event in 2013.

The programme was described as "game changing" in leading industry standards – for introducing cost-effective and major changes to existing maintenance processes. Its Predict and Prevent nationwide approach, which now monitors more than 25,000 assets on a nationwide basis, has directly resulted in an estimated reduction of 450,000 delay minutes – improving service for the travelling public and freight operators. For Network Rail, adoption of the solution has helped deliver a culture change on a national scale. Maintenance teams are better prepared than ever before when maintaining the railway infrastructure. The adoption of a centralised, remote condition monitoring solution for infrastructure asset monitoring places the UK technically in advance of other European rail infrastructure systems.

www.thalesgroup.com

Serco – pantograph testing and overhead line monitoring

Serco's pedigree in independent rail technical services goes back to its origins in British Railways. Combining deep operational and technical know-how with state-of-the-art engineering means the company is in demand from infrastructure managers, railway undertakings and the wider railway supply industry.

Services include non-destructive testing and training, railway engineering, data management and asset management software and consultancy.

As an example of its work, Serco's extensive experience in pantograph testing and overhead line monitoring enabled it to develop an unattended pantograph monitoring system in partnership with Transmission Dynamics Ltd.

This system had to be capable of being fitted to vehicles operating in passenger-carrying service and has been designed to automatically detect and report the type of faults that lead to pantograph damage and possible de-wirement incidents. The fitting of this equipment to trains operating in normal passenger service allows monitoring across large parts of the infrastructure on a daily basis and at line speed without the need to run additional, specialist test trains. The system combines the latest technology to provide accurate locations of incidents using GPS coordinates, real-time data streaming via Bluetooth, signal waveform and context data and statistical mapping of events locations.

www.serco.com/markets/transport/rail

Nomad Digital (Nomad Tech) – telemanagement on trains

Nomad Digital, global leader for high-availability wireless solutions to the transportation sector, has created a joint venture with EMEF, the primary Portuguese operator in the railway maintenance sector, to meet the great rise in demand for telemanagement solutions such as condition-based monitoring (CBM) and energy efficiency in the rail sector.

Telemanagement solutions give rail operators a real-time fleet-wide view of how on-board systems and isolated components are performing in the field. This enhanced, in-depth information allows operators to be more proactive on their operational and maintenance regimes.

Nomad Tech is to develop more services to address demand for improvements in operational efficiency, vehicle availability and reduced lifecycle costs. It will merge CBM tools with a reliability centred maintenance (RCM) strategy to help operators build new business-oriented maintenance processes, where maintenance is based on the condition of equipment and not pre-determined intervals, or to improve existing maintenance management systems. It will also provide a suite of energy-efficiency

tools, including accurate and continuous monitoring of energy consumption, such as drivers' styles (based on brake, throttle and location settings) and fuel levels. This information is incorporated into train driver training programmes for eco-driving techniques. Using the real-time links, operators can also more accurately schedule refuelling and even remotely alert control centres of suspected fuel thefts in progress.

These solutions are proven to deliver significant improvements in energy consumption, availability of trains during peak times, a reduction in new train purchases, a reduction in maintenance costs, and less downtime from fewer faults or repairs, providing rapid business pay-back.

www.nomadrail.com

Balfour Beatty Rail Technologies – maximising the maintenance window

Balfour Beatty Rail Technologies' (BBRT) products and services enhance railway infrastructure asset performance and include specialist solutions for signalling, automated rail inspection and managing the UK's structure gauging data for Network.

BBRT provided London Underground with a solution that gets the best out of its limited maintenance window by moving key parts of the inspection process from the track to the office, allowing work requirements to be better understood and planned and so, better delivered. An important aspect of this is making sure maintenance is carried out at the optimum time, either early or clustered with other works. Frequent measurement is key to providing an early indication of developing faults and a clearer understanding of deterioration rates to help with such decisions. The BBRT solution provided London Underground with an automated unattended track geometry measurement and video monitoring system small enough to be fitted to a normal service train running on the District line. This provided frequent track geometry measurements at dramatically reduced cost compared to alternative approaches.

More frequent measurement and earlier identification of faults calls for automated data management systems that provide a high level of positional repeatability. DataMap is an asset condition visualisation system that includes techniques for accurate and automated alignment of the track condition data. DataMap shows track geometry and video synchronised to location, and the system allows a stop, start, forward and reverse play-back to provide a high level of information about the area of the fault. It has proved very effective at precisely targeting faults and underlying causes, saving time and cost by allowing a more focused repair to be made in the limited access window available. The system is now being implemented across all of London Underground.

www.bbrail.com

Instrumentel – smarter train diagnostics

Instrumentel Limited is a leading designer and manufacturer of electronic systems for precision measurement. Instrumentel's condition-based monitoring rail products are being increasingly adopted by rail operators and maintainers to deliver efficiency and maintenance savings.

The company supplies many of the UK train operators with diagnostic equipment to fit to existing rolling stock. From train door diagnostics to energy metering and engine performance monitoring, Instrumentel products provide rapidly retrofittable, cost-effective solutions for improved asset monitoring in the rail industry. Instrumentel's Door Diagnostic Units offer early warning signs of door deviations and mechanical wear, allowing the maintenance to be planned in advance, before a potential in-service failure occurs. As the performance of every door operation is logged, a historical database is built over time, allowing for environmental factors such as seasonal patterns to be considered too.

www.instrumentel.com

Tracsis – SA380 data loggers for Network Rail remote conditioning monitoring

In 2009, Network Rail began trials of remote conditioning monitoring on the Edinburgh to Glasgow Line. Tracsis' conditioning monitoring subsidiary MPEC was successful in winning sole supply of the hardware for this pilot, where it further developed its hardware to interface to the newly developed Intelligent Infrastructure system. The trials of Intelligent Infrastructure resulted in a 20 percent improvement in the reliability of points and track circuits. Thanks to the enormous success of the trials, Network Rail began and has continued to roll out and develop the system across the network.

During phase one of the project Network Rail spent £13 million, focusing on the assets that caused the biggest problems – points and signalling power supplies. Phase two of the project saw Network Rail spend an additional £24 million to monitor 7,000 track circuits and 3,200 point heaters; failure of track circuits leads to delays as signals revert to red and failed point heaters cause delays as points have to be manually switched.

Tracsis data loggers were fitted to signalling infrastructure and, in conjunction with algorithms developed specifically for the industry, were used to analyse, recognise and generate alerts from the data collected on each asset operation. The devices determine whether the points are experiencing gradual deterioration or are on the verge of imminent failure. As the data is collected, warnings are sent out to Network Rail control centres and engineers, so repair teams can be sent to the correct sites with the right spares and tools to fix problems before a failure can lead to disrupted services.

In one example of the benefits, Network Rail has estimated that the repair of faults before train delay is incurred on their London North Eastern route has saved around 10,000 delay minutes following 140 Intelligent Infrastructure alarms.

Phase three has now begun, with Tracsis continuing as a key supplier under a five-year framework contract. It's estimated that Tracsis will have an installed base of around 12,000 units on the UK Network by the end of 2014.

www.tracsis.com

Image: Network Rail

05 Safety and security

Features

58 Network Rail Consulting
58 Lloyd's Register
59 Atkins
59 Zonegreen
60 Arcadis EC Harris
60 Vysionics

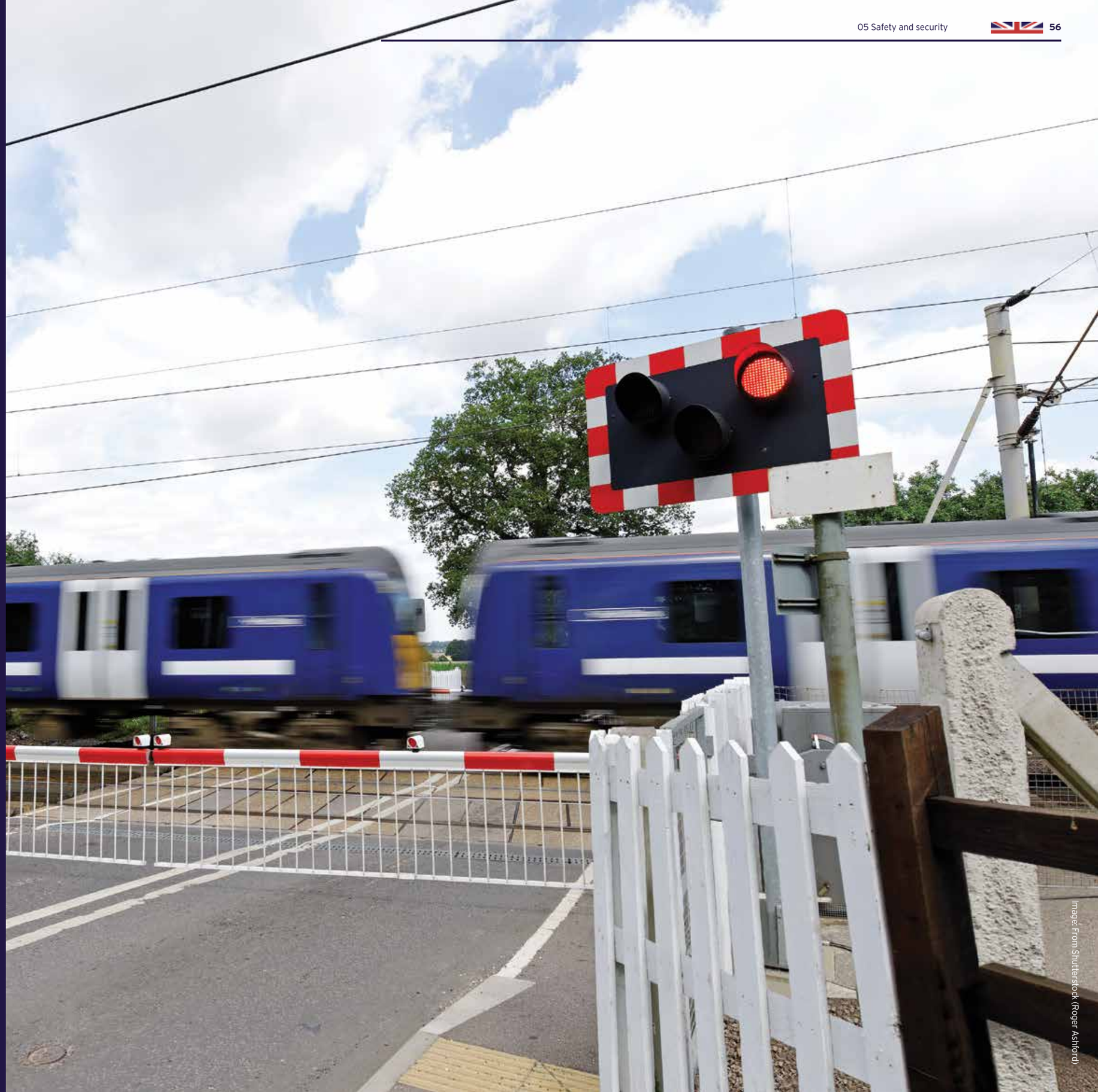


Image: From Shutterstock (Roger Ashford)

Safety and security

It is the UK's experience that sustained investment and a fresh-thinking approach to safety have delivered tangible improvements and real value to rail, ensuring it keeps its unrivalled position as the safest method of surface transport. Today the UK stands as one of the safest rail networks in Europe.

The UK is almost unique in having a dedicated rail industry body in RSSB, which supports the industry collectively with authoritative data, analysis, standards, research and technical expertise in enhancing safety as part of improving business performance.

UK rail companies regard safety as a process of continuous improvement. This is achieved through rigorous safety management, along with developing and applying new technologies, solutions and products that minimise risk, injury and accidents. Prompt and thorough investigation of incidents has long been a cornerstone of railway operation, making the UK's engineers the world leaders in rolling stock fatigue, infrastructure maintenance processes and the identification and analysis of risk factors.

While safety has significantly improved in those areas, there's also motivation for rail, station and train operators to provide a secure and crime-free environment for passengers and staff.

Employing the latest technology, including CCTV and station control systems, along with better station design, can make a considerable difference. Careful assessment of behaviour in crowded stations, along with modelling, can be used to design safer environments for passengers as well as ensuring the best use of space on station concourses.

In 2012, a major CCTV hub opened in London, supported by British Transport Police, train operating companies, Network Rail and Transport for London. Train companies work closely with the police to crack down on railway crime, and their combined efforts have resulted in a decline in recorded notifiable offences.

More than 1,000 UK train stations are now accredited under the Government's Secure Stations Scheme, and train companies have spent millions to make passengers feel safe, including appointing safer travel teams and setting up security control centres.

As safety standards and security requirements become ever more stringent across the globe, rail operators around the world are tapping into the UK's wealth of expertise in improving safety without incurring prohibitive costs.

Network Rail Consulting, Sydney North West Rail Link – independent safety assessor and safety advisory services

Transport for New South Wales commissioned Network Rail Consulting to oversee safety during the construction and delivery of the NSW Government's high-priority rail project – the A$ 8.3 billion North West Rail Link in Sydney. Network Rail Consulting has delivered safety assurance and advisory services in accordance with the latest international railway standards for this flagship project.

The 36km rail link is one of Australia's largest ever transport infrastructure projects. The North West Rail Link will be a fully automated rapid transit system – an Australian first, incorporating driverless trains and state-of-the-art customer safety and security measures.

Network Rail Consulting's safety assessor role focuses on delivering the preliminary safety assessment of the project safety management plan, the safety assurance plan and the reference design safety assurance report; the ongoing independent safety assessment of the main construction contracts throughout their duration, culminating in the preparation of independent safety assessment reports for each contract; and ongoing safety advisory services in relation to the operations and systems contract.

www.networkrailconsulting.com

Lloyd's Register Rail – KORAIL enhanced safety management System

Lloyd's Register Rail (LRR) works to improve the safety, quality and performance of railways across the world. Though renowned for its assurance and certification portfolio, LRR also supports operators, manufacturers and administrators with a range of technical advisory services, from vehicle design to maintenance programmes, from signalling technologies to energy efficiency.

In South Korea, for example, LRR is currently working with the national operator, KORAIL, to enhance its safety management system.

A documented safety management system provides assurance to a railway's stakeholders that all necessary safety procedures are in place and fully understood by staff across the operation. A professionally audited review of current processes, such as incident response and contingency planning, provides an opportunity to benchmark against global best practices and identify improvements that should be made in light of recent operational and technological change.

LRR's work with KORAIL began with a series of on-site audits throughout autumn 2012 to understand existing safety management across the organisation and has since then embarked on developing a five-year roadmap for improving safety and reducing risk across an estate that ranges from rural and city centre stations, to vehicle maintenance depots and freight operations.

www.lr.org/rail

Atkins – safety assurance for Taiwan High Speed Rail

As one of the world's foremost planning, consulting and design firms, Atkins universally acknowledges its responsibility to health and safety, risk management and rail regulation. It continues to work to improve safety standards, while ensuring the principles of behaviour-based safety are embedded throughout.

The Taiwan High Speed Rail project represented one of the largest infrastructure schemes ever undertaken in Asia. Atkins was appointed by the Japanese Contracting Consortium (Taiwan Shinkansen Corporation (TSC)) and its sub-system suppliers to various tasks relating to delivering complex railway systems and railway operations needs for the project.

Atkins' Systems Assurance solution addressed the reliability, availability, maintainability and safety (RAMS) of the core systems, including a specific focus on assurance and certification against CENELEC standards and on fire safety.

Atkins worked in an integrated team with its TSC and sub-system clients to ensure crucial management, engineering and assurance tasks were delivered as demanded by the client. Thanks to Atkins' professionalism and international reputation it was also able to provide standalone assessments and reports to support systems solutions.

www.atkinsglobal.com

Zonegreen – leading-edge safety technology for New Zealand rail network development

Zonegreen is the world market leader in the application of depot safety, efficiency and performance.

The company has supplied its SMART depot personnel protection system (DPPS) to three depots in the New Zealand capital, as well as its depot manager software to two of the depots.

The contract with KiwiRail forms part of New Zealand's extensive programme of railway development, as the industry moves increasingly towards passenger rail. Against this background, Zonegreen's expertise in intelligent rail safety technology is in growing demand in both New Zealand and Australia.

At the heart of Zonegreen's contract with KiwiRail are two of Zonegreen's flagship products, the SMART DPPS and Depot Manager.

The SMART DPPS is a highly advanced protection system incorporating intelligent distributed control and communication technology, as well as electronic personnel datakeys to identify staff working in different safety zones. It's now installed in the vast majority of new UK depots and a growing number of depots worldwide.

The Depot Manager software offers a complete overview of a depot. It provides key information to make operations quicker and easier to implement, ensures the use of safety systems at all times and offers comprehensive traceability.

www.zonegreen.co.uk

Arcadis EC Harris – development of the framework for the new government railway regulator in Saudi Arabia

Arcadis EC Harris' Safety and Risk Management (SRM) team based in the UK has been responsible for developing, on behalf of the Kingdom of Saudi Arabia, the framework for a new railway regulatory body known as the Saudi Railways Commission (SRC). The SRC will be responsible for implementation and oversight of the new railway laws, and for regulating the greatly expanding railways within the Kingdom.

The scope of the work was broad ranging, and included determining and defining the SRC's organisational structure and key roles, preparing job descriptions for all roles in SRC, and writing the SRC's internal economic and safety regulation working procedures, based on European economic and safety regulation best practice.

As well as having developed the railway regulatory framework, Arcadis EC Harris is also now leading the regulatory function of the SRC, with expert advisers who are responsible for determining the organisation's budget and for its day-to-day operations. A key element of this leadership is to recruit and mentor local personnel.

Services delivered by Arcadis EC Harris include organisational design and task analysis, specification of regulatory functions for a railway regulator, determination of job roles, responsibilities and job descriptions, design of safety, technical and economic regulation processes, preparation of procedures for licence and safety certificate applications, controlling access to railways, dealing with disputes, and procedures for compliance and enforcement by rail industry concessionaires.

www.echarris.com

Vysionics - Level crossing protection

Vysionics is a global leader in the development of ANPR (automatic number plate recognition) based enforcement systems, with a number of devices having achieved the demanding UK Home Office Type Approval, which is needed to allow automatic enforcement of traffic violations. Its most well-known solution is the SPECS average speed enforcement family, which has now been operated on more than 300 temporary and permanent sites.

Having invented ANPR 30 years ago, Vysionics' work on thousands of enforcement-related camera installations has enabled its products and services to evolve continually to provide the best achievable solutions.

The latest addition to this enforcement range is VECTOR LX, a highly capable standalone system detecting and capturing traffic violations at level crossings. VECTOR LX obtains and analyses data at level crossing sites using a unique combination of ANPR, video and scanning radar. This integrated approach means that VECTOR LX not only identifies and produces evidence for enforcement when offences occur, but also gathers a wealth of "situational awareness" data to identify behaviours at different times of day. As a result, the system captures offences – for instance, a car driving through red lights and/or around barriers – and provides the data that allows better decisions to be made to prevent future problems. All of this is delivered without the need for road loops or intrusive connections into the traffic signals, providing a system that is powerful, effective and simple to maintain.

www.vysionics.com/vectorlx

06 Operations

Features

64 Arriva
64 National Express
65 Freightliner
66 Serco

Image: UKTI

Operations

Train operations in the UK have improved significantly thanks to investment in infrastructure and asset management, together with privatisation and franchising.

Train operators and their suppliers have invested hundreds of millions of pounds in refurbished depots, maintenance and service facilities to make sure trains are more reliable than ever. Notable examples include South West Trains' 30 percent improvement in the reliability of its commuter fleet, Southern's £115 million complete overhaul of its depot at Selhurst, and East Midlands Trains' £22 million expansion of facilities at Derby.

Smarter driver training has also made a difference, with train operating companies investing more than £20 million in 20 state-of-the-art driver simulators.

This work sits alongside the ongoing improvements in signalling led by Network Rail. Every day, Network Rail's team operates more than 40,000 signals from 800 signalling locations. They make the day-to-day signalling decisions and manage train recovery plans during disruption. Network Rail is set to consolidate signalling and control activity into 12 modern rail operating centres over the next 15-30 years as part of its strategic modernisation plans. Six new rail operating centres will be built to supplement the six locations already identified, all with the latest technology and tools to better manage and control the railway.

The benefits include:

- less delay: better technology will help restore normal service much more quickly following disruption
- more flexibility and capacity: more reliable performance and better train regulation
- reduced operating costs: a more affordable railway with more passengers, helping to create a sustainable future for the rail network.

Another important factor in the story of improved rail operations is the UK franchising model, which gives private operators commercial incentives to attract more passengers and contain costs. If they do this successfully, train operating companies can reap profits, although many contracts ensure that revenues or operating margins that exceed pre-agreed levels are shared with Government.

In a franchise, bidders must identify ways of generating increased revenue, either to pay Government or reduce subsidy – through innovation in areas such as customer service and pricing, or through better timetables and investment. In the UK, this has seen passengers benefiting from an injection of new ideas and competition, while train companies' operating margins have been modest.

UK rail franchising has attracted a range of companies and organisations eager to participate and improve the passenger experience. This includes both international and domestic train operating companies including Arriva, FirstGroup, Govia, National Express, Stagecoach Group and Serco. As other national railways now look to the franchise model, international clients are increasingly seeking UK expertise in structural reform and rail operations.

National Express

National Express operates the UK's leading rail franchise, c2c. It holds both the UK monthly and annual punctuality records, and has been the UK's most punctual operator for the last two years. It also has the highest customer satisfaction score – 92 percent – of any UK rail franchise in the latest National Passenger Survey.

c2c has also recently achieved a 5 star score, the highest level in the European Foundation for Quality Management's Recognised for Excellence assessment. This rigorous assessment of how the business is run is the benchmark for the industry.

National Express's reputation for excellence has also been recognised with the award of two rail contracts in Germany, serving cities including Cologne and Bonn in Germany's most populous region, North Rhine-Westphalia. The contracts are for a regional express service between Rheine-Münster-Cologne-Krefeld and a Bonn-Cologne-Wuppertal stopping service.

Currently run by Deutsche Bahn, the services carry around 18 million passengers per year. National Express will start operating the 15-year contract in December 2015, after first procuring 36 new electric trains on behalf of the local authorities.

National Express is also currently shortlisted for other German rail contracts, including the Berlin RingBahn services.

www.nationalexpress.com

Arriva

Arriva is one of the largest and most successful transport services organisations in Europe with over 54,500 employees operating 19,500 buses and more than 750 trains (as well as metros, trams, funiculars, waterbuses and paramedic transport), carrying more than 2.2 billion passengers each year.

Apart from the UK where the company has a country-wide presence in both bus and rail, Arriva has significant bus operations in 13 other countries across Europe and operates rail networks in the Netherlands, Denmark, Sweden, Poland, The Czech Republic and Portugal.

Arriva actively engages with national, regional and local governments in each of its markets to tailor innovative high-quality transport solutions that provide good value for money, deliver on policy objectives and give passengers a safe, dependable and attractive alternative to the private car.

As a result, from Aberdeen to Aarhus and from Madrid to Mladá Boleslav, Arriva's buses and trains provide essential services that can be relied on by passengers whether they are travelling to work or school, on business, or for leisure.

Though UK-based, Arriva has, since 2010, been part of Deutsche Bahn and so it has access to the extensive knowledge, experience and resources of one of the world's leading passenger and logistics service providers.

www.arriva.co.uk

Freightliner

Freightliner Group is a leading rail freight operator based in the UK, with operations across Europe and in Australia and a clear strategy for further global growth. Freightliner provides bulk haulage rail, intermodal rail and road services, and maintenance solutions for rolling stock as well as offering contracted passenger rail services.

As a service leader in rail freight operations globally, the group has extensive experience of both establishing and operating high-quality, customer-focused rail freight services. It has more than 15 years of best-in-class market leadership with a strong track record of:

- successfully starting up rail freight operations in different cultural and geographical locations and scaling up capacity to meet customer requirements
- engaging with individual customers to deliver services tailored to meet their specific needs
- operating industry-leading health and safety and reliability standards
- selecting and training local staff with the skills, aptitude and attitude to deliver high standards of service
- working with suppliers to design, procure, finance and maintain rolling stock to get the best network performance
- increasing rail throughput by getting the best out of customers' railhead design and operations
- operating and owning port-based rail terminals and working with third-party port-based terminal operators to optimise container flow through the port
- operating and establishing intermodal networks with owned, leased and third-party terminal facilities ranging from single track sites with mobile lifting equipment to multi-track facilities equipped with multiple gantry cranes
- developing IT solutions to improve information flow and performance across the network
- planning and controlling rail services on a multi-operator mixed freight and passenger network.

Freightliner's objective, together with local partners, is to develop a local operating company that can deliver world-class rail services.

www.freightliner.co.uk

Serco

Serco is a UK-listed service and outsourcing company that's been delivering essential public services for more than 40 years. More than 100,000 employees deliver mission-critical services to clients in over 30 countries. The company has a wealth of experience in new-build rail and metro systems and operating and maintaining existing ones – with the common outcome of providing a transformed customer experience. Serco works in highly effective trusted partnerships with its clients to ensure that its promises are delivered.

In the UK, Serco has been operating and maintaining the pioneering automated Docklands Light Railway on behalf of Transport for London since 1997. Serco has played an important part in making the DLR one of the most successful railways in the world – delivering sustained high levels of punctuality, reliability, safety and security, winning an unprecedented number of awards and contributing to the success of the London 2012 Olympic and Paralympic Games.

Together with Abellio, its joint venture partner, Serco delivers two of Great Britain's train operating companies. Merseyrail is a 25-year concession awarded in 2003, providing local train services to the Liverpool City Region. Since 2004 Serco has operated Northern Rail – providing urban and rural train services across the north of England.

In the Middle East, Serco successfully implemented the initial stages of the Dubai Metro on behalf of Dubai RTA, and is sustaining one of the top performing metros in the world. It also operates and maintains the Palm Jumeirah Monorail and an Automated People Mover at Dubai Airport. In 2013 Serco was awarded the contract to operate the Al Sufouh Tram system in Dubai.

In Australia Serco owns Great Southern Rail, operating the iconic trans-continental tourist trains including The Ghan and the Indian Pacific, providing guests with the trip of a lifetime.

www.serco.com/markets/transport/rail

Image: Serco

07 Ticketing

Features

70 ACT
70 Masabi

Image: From Shutterstock (Lilia Beck)

Ticketing

The changing needs of the UK's commuting workforce are driving a transformation in the way fares and ticketing are managed across the network.

Different types of commuters have entered the picture, from those who work more flexible hours to the growing number of smartphone-using travellers who enjoy the convenience of buying rail tickets online.

Rail Fares and Ticketing: Next Steps, published in October 2013, sets out the Government's vision for a modern and customer-focused fares and ticketing system. It aims to make sure passengers benefit from the new ticketing options made possible thanks to advances in technology, while ensuring the most is made of opportunities to reduce costs and increase the productivity and efficiency of the railway.

Smart ticketing is an opportunity to give passengers faster, simpler and more flexible ticketing systems. The benefits have already been seen in London's Oyster card system, and there are plans to roll out smart ticketing across the rail network.

The Government recognises the importance of using new technology to improve ticketing systems, as long as passengers continue to enjoy high levels of service and flexibility.

In fact, the UK was one of the first markets worldwide to offer online ticketing, allowing any company to retail tickets, delivering them for collection on departure.

Now, anyone can purchase tickets on their smartphone for anywhere in the UK, with a number of routes offering 'end-to-end' barcode ticketing for passengers who don't want to have to queue to collect tickets and risk missing their train.

These advances result from home-grown technology companies working in partnership with some of the largest transport-owning groups worldwide. And these skills, relationships and innovations are prime for being exported across the globe.

Image: Max Klatt/The Team

ACT – the key to smart ticketing

ACT is a proven leader in designing, building and managing smart transaction systems, including solutions that speed commuters through public transport, help shoppers earn rewards, provide access to public services and make it easy for visitors to explore new places.

In the transport sector, ACT provides leading UK commercial transport operators and public transport bodies with interoperable smart ticketing platforms that join up regional and national services.

The company also offers this vast experience in industry-compliant smart ticketing systems as a supplier to major UK train operators including London Midland, First ScotRail, Southern Rail and c2c.

London Midland, which runs more than 1,300 train services a day throughout the heart of England, connecting London, the Midlands and the North-West, supports more than 50 million passenger journeys each year.

Aiming to put passenger convenience at the heart of its service while keeping ticketing overheads down, the train operator asked ACT to provide the technical platform for a smart ticketing scheme compliant with the UK Government-backed ITSO specification. (ITSO specifies the secure technical, electronic platform on which UK smart ticketing schemes can be built.)

The convenience of online ticketing services and a single interoperable smart card has made it easier for passengers to manage their travel and payment arrangements. In turn, London Midland benefits from having more passengers prepaying and arriving ready to board with their valid ticket, which helps speed up boarding times, reduce retailing costs and lower ticket administration costs.

ACT provided all the central applications, including its HOPS transaction-processing engine, Customer Management System (CMS) and Retail Fulfilment Service (RFS). It co-ordinated and integrated all the third-party systems, including gates, ticket vending machines, platform validators and a web-based consumer portal to support journey planning. On an ongoing basis, ACT back-office systems manage the card lifecycle, including the issuance of the smart card, called "the key".

www.weareact.com

Masabi – smartphone ticketing delights passengers and saves millions

In 2012, to cut the cost and inconvenience of on-board cash purchases, Boston's MBTA was looking to extend its smartcard, CharlieCard, to its Commuter Rail network. With more than 140 stations, the majority of which didn't have ticket vending facilities, this would allow customers to move away from paying on-board with cash, reducing the costs of cash handling. However, the proposed smartcard project was expected to cost more than $70 million in CAPEX alone.

By deploying Masabi's JustRide mTicketing system, the MBTA, the USA's fifth largest transit agency, was able to achieve its aims while delivering an experience that delighted riders and set the bar for agencies across the country – all with a CAPEX that was a fraction of the expected smartcard cost.

Masabi was chosen to deliver its complete turnkey mobile ticketing solution, JustRide. This comprised a consumer app – ready for riders to buy and display their tickets; a validation application for conductors to verify tickets; and a management console for the MBTA to get reports, administer ticket rules and run customer service operations.

Mobile ticketing for transit has been pioneered by Masabi, launching its first technology pilot in 2007. Today it works with more than 17 operators worldwide. The company's mTicketing technology is deployment proven with millions of downloads of its applications processing millions of dollars of tickets each month.

In August 2013, just nine months after launch, the MBTA sold its one millionth ticket via the app, totalling over $10 million in sales. At this point, mTicket was retailing the equivalent number of tickets to vending machines – and growing – thanks to strong customer uptake and expansion to other parts of the system.

www.masabi.com

08 Training

Features

74 Babcock

74 TUCA

75 Bridgeway Consulting

75 The National Skills Academy for Railway Engineering (NSARE)

76 National Training Academy for Traction and Rolling Stock (Siemens)

Image: Babcock

Training

Recognising the need to address skills shortfalls in the rail sector, the UK has embarked on a number of long-term and ongoing initiatives to fill this gap.

The National Skills Academy for Railway Engineering (NSARE) has been established with wide railway industry support to help tackle current and future skills needs in the railway engineering industry. The industry's vision is that by 2015, its engineering workforce will have the right skills to support the maintenance, development and expansion of a first-class, cost-effective 21st-century railway.

Network Rail, London Underground, the train operating companies, rail contractors and rail supply chain are investing significant resource in training.

Nearly 300 organisations across the UK rail sector are members of NSARE. These include employers who are training and developing their own staff, along with training and skills bodies such as private providers, in-company training providers, further education colleges and universities.

Network Rail has set up its own state-of-the art training and development centres, with almost all its training and development delivered by its own people. This includes 11 maintenance training centres across the UK, with 110 trainers who are all former maintenance workers. It also has two signalling training centres, where signallers can get the most up-to-date training, including computer-based materials and signal panel simulators. Training programmes meet national demands and are fully accredited, from NVQ to Masters Degree level.

The Tunnelling and Underground Construction Academy (TUCA) has been established to ensure Crossrail has the skills needed for its construction, and also meet future skills needs for the UK. TUCA will be retained post-Crossrail as a specialist training centre for other tunnelling projects – thus becoming a legacy to the UK construction industry.

Most recently, the UK Government announced that the UK's HS2 rail project is to have a dedicated further education college to train engineers. This development recognises that investment in the railway should also come with investment in the elite skills that will help build it. The college will open in 2017 and will have a specific focus on rail construction and maintenance. Again, this will provide students with skills that respond not only to the needs of HS2, but also to the future of rail engineering in the UK.

The skills gap in the rail sector is not unique to the UK but is felt the world over. UK rail expertise is much valued and many overseas rail operators now look to the UK for their training and development needs. Training is being delivered to overseas clients by a wide range of UK organisations, including universities and colleges, engineering consultants and contractors and dedicated private training companies.

Babcock – tailored training for Network Rail

Babcock is the UK's leading vocational learning provider. Using its expertise in complex programmes, critical assets and training, Babcock has developed tailored training programmes that include the Network Rail Advanced Apprenticeship Scheme. This is one of the UK's largest apprenticeship training programmes, accommodating up to 240 apprentices each year.

Since the start of the contract, 1,900 apprentices have progressed through the programme, which is designed to meet the specific requirements of Network Rail's operations. The initial course of study gives the apprentices a sound underpinning in engineering, leading to NVQs and a BTEC National Award technical certificate. Babcock also manages the assessment and internal verification of the apprentices' portfolios. As well as technical training, the programme also instils Network Rail's corporate values, vital to the company's success in developing a world-class workforce.

Training is residential, to provide a broad education over and above a standard apprenticeship, with extra-curricular activities and pastoral care. Babcock works in partnership with Network Rail to make sure each delegate is given individual health and dietary plans and support to promote positive wellbeing.

Extra value has been added to the partnership with Network Rail through facilities management and management of additional programmes such as the Graduate Leadership Programme, Sport and Leisure Institute and one-to-one coaching.

The quality of the training provided by Babcock has been recognised both by the customer and externally. An inspection by the Adult Learning Inspectorate awarded a high score for the overall effectiveness of the engineering and manufacturing technologies training. The Engineering Academy, which is operated and managed by Babcock, is home to the Network Rail programmes. The academy is one of the largest engineering training establishments in Europe and holds the Beacon Status award, placing it in the top one percent of UK training providers.

www.babcockinternational.com

TUCA – the future of tunnelling

The Tunnelling and Underground Construction Academy (TUCA) was built and established by Crossrail to develop and upskill a workforce for the UK's largest infrastructure project for many years.

With a need to train and upskill thousands to work on the project and then looking forward to future projects, TUCA was created as a centre of excellence for a sector that required specialist skills and is proud to be the only training centre in Europe dedicated to soft-ground tunnelling techniques.

TUCA is managed by CITB/National Construction College. Over the past two years more than 10,000 delegates have undertaken training in this purpose-built, state-of-the-art facility in Ilford, Essex. It has also received much interest from overseas contractors and international projects.

Working with industry, TUCA is continually developing new provision in line with the needs of today and what's expected over the coming years. With provision offered across a wide spectrum, TUCA is ideally placed to develop the workforce through upskilling programmes and bring in a new workforce through specialist apprenticeships and a robust pre-employment training programme.

Set over two floors, TUCA houses a variety of specialist training facilities including a simulated pit top, pit bottom and running tunnel environment, gantry crane training area, sprayed concrete lining (SCL) equipment and simulators, concrete testing laboratory, a dedicated plant training area, loco driver training facilities, full restaurant facilities and a number of teaching rooms fitted out to a very high standard.

Having been central to the Crossrail project, TUCA will eventually become a long-term provider of underground construction skills for other major infrastructure projects.

www.citb.co.uk/training-courses/tunnelling
www.citb.co.uk/tuca

Bridgeway Consulting – railway technical training for Iarnród Eireann (Irish Rail)

Bridgeway Consulting Ltd is a leading consulting and contracting company offering a diverse range of services including railway engineering and safety training, mentoring and assessments.

In 2013 Iarnród Éireann appointed Bridgeway Consulting to carry out railway technical training for Irish Rail permanent way staff.

The training course objective was to develop the technical proficiency and competency of Irish Rail staff responsible for the maintenance, installation, renewal and repair of the rail permanent way (track, points and crossings, level crossings, boundary fences and lineside features and equipment).

The bespoke training courses were developed jointly by the Bridgeway Consulting learning and development team and Irish Rail engineers to suit the specific needs of the Iarnród Éireann system.

The training is delivered at training facilities in Dublin and reinforced by hands-on practical training on a 100m purpose-built training track. This contains a variety of railway track components including rails, sleepers, switches/crossings and even a platform. There are plans to replicate these facilities in Limerick and Athlone during 2014.

The rail training is delivered by a number of Bridgeway Learning and Development specialists – all of who possess proven railway experience and professional training qualifications. Bridgeway Consulting is currently officially graded as the UK's number one rail training provider by the National Skills Academy for Railway Engineering (NSARE).

www.bridgeway-consulting.co.uk

The National Skills Academy for Railway Engineering (NSARE)

The National Skills Academy for Railway Engineering (NSARE) was established in November 2010 and is a not-for-profit company limited by guarantee, wholly owned by its members.

NSARE members include large and small rail industry employers, training providers including further education colleges and universities, and other rail industry stakeholders. NSARE doesn't deliver training but works with employers to understand their skills needs, with training providers to ensure they're delivering what the industry needs, and with other stakeholders to make sure the industry has people with the right skills.

NSARE's services include:

- promoting the rail industry as a "career of choice" in schools, colleges and universities
- forecasting future railway skills needs at both industry-wide and individual employer or specific skill level
- developing standards and qualifications to meet the industry's needs, including apprenticeships and university courses
- Quality Assurance of rail industry training provision, including establishing networks of accredited providers, trainers and competence assessors
- developing competence management systems, including national databases of skilled engineers
- providing and managing an integrated IT system capable of managing accredited providers, individuals competencies, qualification and skills
- training needs analysis
- training and skills-related consultancy for individual clients.

Specific examples of consultancy work undertaken include:

- carrying out a feasibility study to predict the impact on the UK rail industry workforce of the European Rail Traffic Management System (ERTMS)
- establishing and managing a national training academy for traction and rolling stock, in collaboration with Siemens and the UK Government.

www.nsare.org

National Training Academy for Traction and Rolling Stock

Some 13,500 people work in specialist traction and rolling stock roles across the UK. Skills are the foundation of a thriving, hi-tech rail industry as more people choose to travel by rail and trains become increasingly technologically advanced.

Siemens, in collaboration with NSARE, is playing an integral part in ensuring rail industry employees have the skills and competencies needed to maintain the next generation of trains in which the UK Government is investing. As a result, a state-of-the-art training academy, specialising in traction and rolling stock skills, will be opened at the site of Siemens' existing flagship train depot and UK service headquarters in Kings Heath, Northampton.

An agreement between NSARE and the Department for Business, Innovation and Skills, with support from the Department for Transport, will provide half the funds needed, with Siemens contributing the other 50 percent.

The academy is expected to open its doors in spring 2015, creating around 100 jobs in during its construction and, subsequently, in operations.

Offering 20,000 man days of training per year, the academy will act as a national "hub" with regional "spokes" located around the country. The focus will be on addressing the future skills shortage in this part of the UK rail sector – forecast to be around 4,500 people over the next five years. This is thanks to a combination of factors such as an ageing workforce, the technological advancement of rolling stock, and investment and growth in the industry.

In addition to encouraging more entry-level talent, existing rail industry employees will also benefit from an opportunity to "upskill" in response to industry advancements and new train developments such as "fly-by-wire" (a system that replaces the traditional manual controls of a train with a precision electronic interface) and ERTMS – replacing traditional signal controls with a computerised, in-cab display).

www.siemens.co.uk

Image: Babcock

09 Innovation in action

Features

81 Railway Industry Association
81 Aerospace lift for train door design
82 FutureRailway Enabling Innovation Fund
82 The Technology Strategy Board
83 DIFCAM
83 Virtual Lineside Signalling
84 Collaboration on energy-efficient powertrain systems

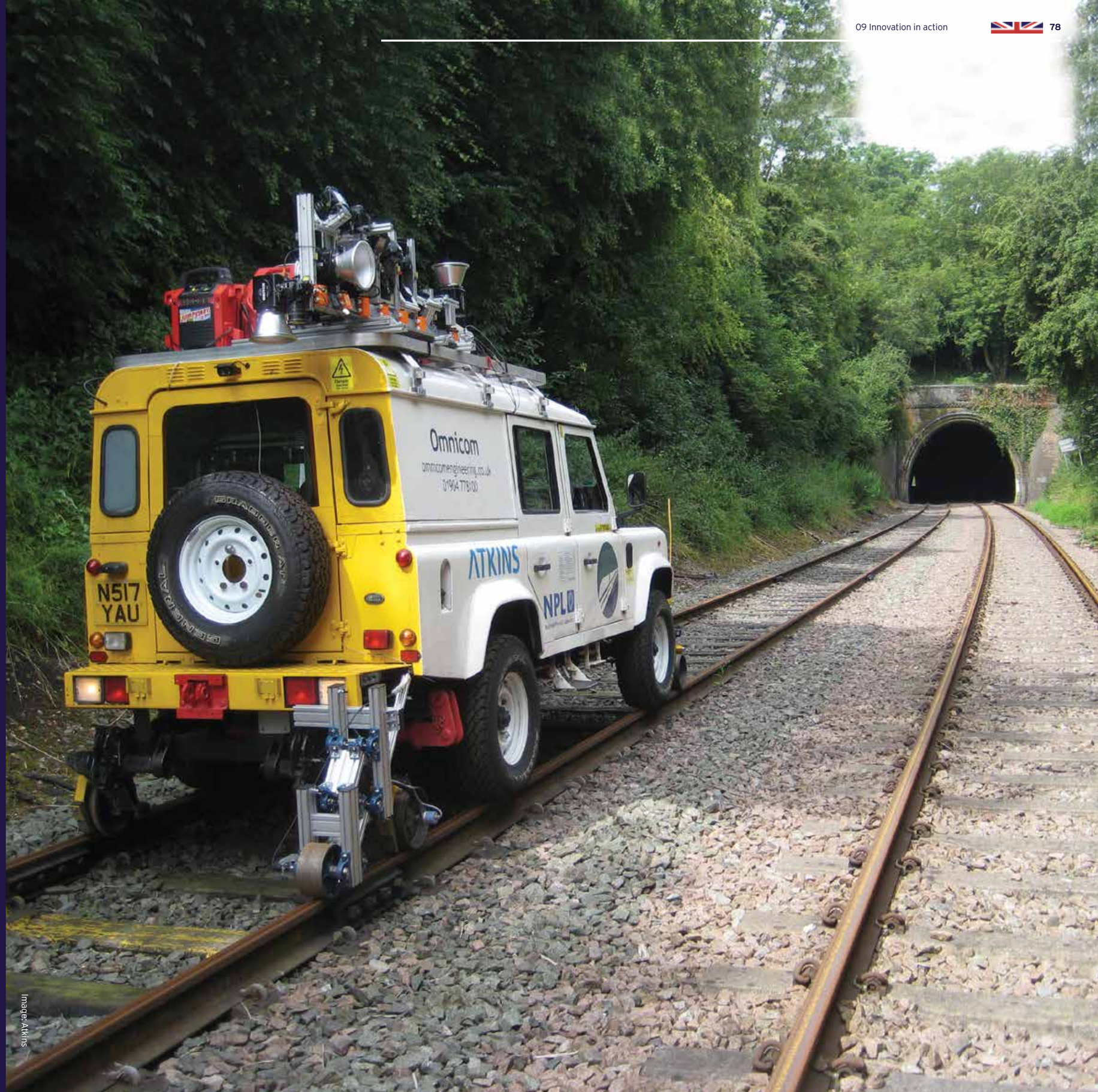


Image: Atkins

Innovation in action

From wide-reaching research and development to new uses of technology in rail products, there's a diverse range of work supporting the transformation of the UK rail industry through innovation.

Here, we focus on just some of the initiatives that have the development of the UK rail industry at heart. Along with the examples you'll have already seen in this brochure, we feature instances of innovation at work, including many that involve collaboration across the supply chain.

As well as the many organisations and private sector initiatives supporting rail innovation, the UK's academic and dedicated research institutions are contributing to this dynamic picture through the research and development (R&D) they conduct. (You can read more about the work of the UK's universities in the section that follows this one.)

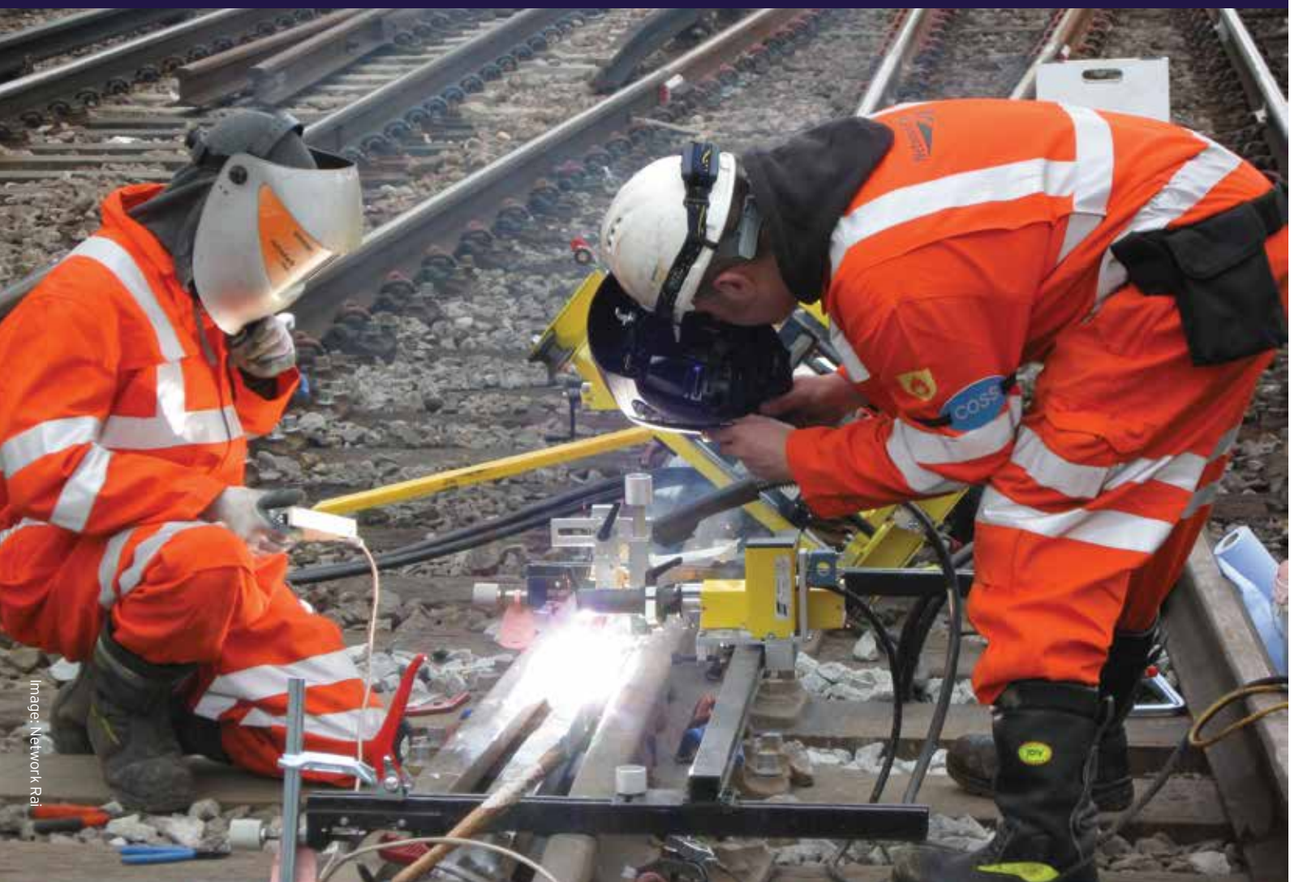


Image: Network Rail

Activity around innovation in the UK falls across the four areas of R&D push, supplier response, client strategic pull, and innovation enablers:

R&D push

The UK has strong rail research capability.

RSSB runs a cross-industry R&D programme sponsored by the UK Department for Transport.

Network Rail runs its own research and innovation programme.

RSSB and Network Rail fund and manage the Rail Research UK Association (RRUKA), which links up industry and universities to support research.

The Technical Strategy Leadership Group (TSLG) directs the strategic element of the RSSB cross-industry research programme and published the Rail Technical Strategy (RTS) setting out how technology can deliver a better performing, more cost-effective railway.

This is delivered by the FutureRailway team, which has a £250 million plan to enable research and innovation in the rail sector including its supply chain.

Supplier response

Suppliers represented by the Railway Industry Association (RIA), the Rail Alliance and the Derby & Derbyshire Rail Forum (DDRF) have always innovated when it comes to their products, and continue to do so.

Client strategic pull

There is a strong strategic pull from key clients and leadership groups who are setting strategies.

Network Rail, Transport for London and Crossrail have innovation teams and have publicly identified the challenges they seek to address. All three organisations also have innovation portals where suppliers can submit ideas.

Innovation enablers

A number of organisations and initiatives are enabling innovation in the UK. This includes supporting, and sometimes part-funding, the more challenging, unproven, higher risk, earlier-stage innovations.

Aerospace lift for train door design

New lightweight Tube train doors being designed for London Underground should weigh less on the budget as well as being impressively state-of-the-art.

A consortium of Atkins, Wabtec Corporation, the National Composites Centre and University College London, led by London Underground, has been working on the design and engineering of the new composite doors, funded by RSSB and the Technology Strategy Board.

Lighter doors retrofitted to existing carriages would open and close faster, reducing dwell times at stations. At the same time lightweight doors fitted to new carriages could be larger, compounding that benefit.

The consortium's challenge was to reduce the weight of the existing Central line door by almost 40 percent, using materials from the aerospace sector, yet meet the exacting standards on fire safety and resistance to damage.

The solution lay in a glass-fibre reinforced thermoplastic material for the door's main structure. This material is tough, resistant to environmental damage and fire resistant. Supplied by Tencate, the material is also 100 percent recyclable and suitable for medium-to-high volume manufacturing. The glazing is also innovative, as it uses a prototype glass/polycarbonate laminate. The toughened glass face sheets protect the low-density polycarbonate inner part from fire, and the weight of the window is expected to be half of the original.

The projected weight saving of the prototype door is just under 30 percent, and although the materials and labour cost of the door would increase, maintenance and warranty costs would be expected to drop. The projected annual benefit to London, thanks to reductions in passenger journey time, is £4.7 million, with associated revenue income of £1.3 million to London Underground. As well as that, the benefits of reducing track wear and energy consumption amount to £0.5 million per annum.

This project is one of the winners of the UK's Technology Strategy Board and Rail Safety and Standards Board Accelerating Innovation in Rail competition.

www.atkinsglobal.co.uk

www.wabtecrail.co.uk

www.nccuk.com

www.ucl.ac.uk

www.tfl.gov.uk

Railway Industry Association – Unlocking Innovation Scheme

The Unlocking Innovation Scheme aims to improve the railway supply chain's capability to innovate with new technology, processes and business models – to benefit Britain's railways and grow exports.

Through the scheme, more than 100 people who care about innovation in the rail sector come together in regular workshops that aim to:

- nurture a dialogue between clients and suppliers
- help suppliers find partners to help progress their innovations
- improve access to a wide variety of funding mechanisms
- provide free access to resources to help suppliers commercialise their concepts
- introduce techniques to improve creativity in the workplace.

Anyone who wants to make innovation happen in the rail sector is welcome: clients, rail (and non-rail) sector suppliers, academia and organisations that facilitate or fund innovation. The scheme is one of the initiatives under the Future Railway umbrella, working with and on behalf of the cross-industry TSLG.

https://connect.innovateuk.org/web/unlocking-innovation-in-rail

The Technology Strategy Board

The Technology Strategy Board is the UK's innovation agency. Its role is to stimulate innovation, working with business and other partners, in order to accelerate economic growth.

Its vision is for the UK to be a global leader in innovation and a magnet for technology-intensive companies, where new technology is applied rapidly and effectively to create wealth.

Established by the Government, the Board operates at arm's length as a business-led executive non-departmental public body (NDPB), and is sponsored and funded by the Department for Business, Innovation and Skills (BIS).

It's responsible for a number of networking and partnership initiatives, including:

- Catapult Centres
  Catapult Centres are designed to transform the UK's innovation capability in key areas to help drive future economic growth. There is a dedicated Transport Systems Catapult, which spans the road, rail, marine and aviation sectors.
  https://ts.catapult.org.uk
- Connect
  Connect is an open innovation and networking portal designed to accelerate business innovation. Connect hosts a number of Knowledge Transfer Networks, as well as the Unlocking Innovation Scheme's online group.
- Knowledge Transfer Networks (KTN)
  KTNs are innovation communities that connect, collaborate and find out about new opportunities in key research and technology sectors. There is a KTN dedicated to transport, who bring together the road, rail and marine sectors.
- Knowledge Transfer Partnerships
  Knowledge Transfer Partnerships offer businesses the opportunity to work with academic institutions to access new knowledge.

www.innovateuk.org

FutureRailway

The FutureRailway Enabling Innovation Fund was set up to accelerate innovation in the rail industry.

Its mission is to offer support to practical cross-industry demonstrator projects, building on the work of the Technical Strategy Leadership Group (TSLG) while seeking out original ideas from across the industry.

The FutureRailway vision is to enable a culture of innovation and entrepreneurship across the whole rail industry, delivering growth for the British economy and a transformational change for the railway.

The team's approach is to understand the challenges that industry faces, connect potential innovators with these challenges and, where necessary, with potential funding. It has backing from across the industry at the highest levels. The Enabling Innovation Fund invests in four main ways:

- enabling projects – such as investing in facilities that will help to demonstrate innovative technologies or business concepts, or projects designed to help innovators target the needs of the rail industry
- calls and competitions – targeted at addressing specific industry challenges
- ideas from industry – an open application route for innovative concepts that need support for demonstration trials
- special projects – those that have a clear business case, established route to market and which could deliver a step change to the industry.

www.futurerailway.org/eit

VLS – signalling a low-cost solution

Virtual Lineside Signalling (VLS) is a cab signalling system developed by Park Signalling that could revolutionise low-cost signalling on secondary lines.

VLS makes use of wireless mobile data and location sensor systems to securely send in-cab signalling displays to train drivers, and convey train location and status reports back to signalling control centres. By taking away the need for most conventional trackside signalling equipment, cabling and power supplies, it can significantly cut the cost of primary signalling on rural or lightly used lines and provide fallback signalling on other lines.

In March 2012 a joint, collaborative bid by Park Signalling Ltd (PSL) and Frazer-Nash Consultancy (FNC) won the inaugural RIA/RSSB Innovation Competition. The resulting RSSB funding award allowed PSL to commission FNC to perform an independent safety analysis of VLS, and for PSL to develop a novel central interlocking interface.

The safety analysis work, which was split into three stages: Proof of Safety, Train Cab Unit Safety and Interlocking Interface Design Safety, concluded that VLS could form a demonstrably safe signalling system.

Since early trials of a prototype VLS system on a heritage railway line in the UK, VLS has been demonstrated on Network Rail infrastructure. What's more, the Radio Frequency Identification (RFID) train location and wireless mobile communications systems, both of which are based on Commercial-Off-The-Shelf (COTS) equipment, have been successfully demonstrated at Network Rail's RIDC test track and on board in-service trains on the Yorkshire Wolds Coast Line.

www.park-signalling.co.uk

www.fnc.co.uk

DIFCAM – automating visual inspection

Digital Imaging for Condition Asset Management (DIFCAM) is a fast, efficient, automated method for basic visual inspection of structures. It cuts down the need for costly, dangerous trackside access and subjective factors associated with human visual inspections.

Supported by RSSB and the Technology Strategy Board, DIFCAM assesses asset condition by comparing digital images taken at different times to automatically detect changes that would be difficult for a human inspector to achieve. It does this by comparing pixel blocks at very high resolution.

Developed by a consortium of Omnicom, the National Physical Laboratory (NPL) and Atkins, the initial DIFCAM demonstrator will be used to inspect rail tunnels, of which there are 20,000km worldwide.

However, DIFCAM can also be put to use for asset inspection in other industries, including in hazardous and confined areas. In this consortium, Omnicom provide the position platform and profiling system, NPL offers high-resolution imaging and analysis and Atkins offers asset management and domain expertise.

DIFCAM is one of the winners of the UK's Technology Strategy Board and Rail Safety and Standards Board Accelerating Innovation in Rail competition.

www.atkinsglobal.co.uk

www.omnicomengineering.co.uk

www.npl.co.uk

Cross-sector collaboration that makes innovation fly

Global rail vehicle manufacturers are working with UK technology companies to develop energy-efficient powertrain systems that exploit pioneering developments in other sectors.

Two current initiatives that involve applying flywheel energy storage technology to rail propulsion perfectly illustrate this cross-sectoral collaboration.

- Bombardier Transportation is collaborating with Artemis Intelligent Power and Ricardo in a diesel multiple unit regenerative braking project using a hydraulic system to charge and discharge a flywheel.
- Alstom is collaborating with Williams Hybrid Power to develop flywheel energy storage technology for Citadis trams.

The flywheel technologies underpinning these developments have their origins in the energy supply sector. The high speed flywheels involve carbon fibre filament winding technology developed by the UK Atomic Energy Authority/Urenco for ultracentrifuge uranium enrichment systems needed by the nuclear power industry. Meanwhile, the Artemis hydraulics technology originated from work in Edinburgh University's Fluids Group aimed at power take-off for renewable energy devices. Both Williams HP and Ricardo have used their motorsport involvement to develop their capability in flywheel drivetrain technology – such as in Kinetic Energy Recovery Systems (KERS) systems for F1 cars. This illustrates the role that thriving UK design engineering and motorsport sectors play as agents for cross-sector technology transfer and innovation.

These developments have paved a route for mainstream rail uptake of flywheel energy storage, seeing niche application in the Parry People Mover Class 139 railcar service on the Stourbridge Town–Stourbridge Junction branch line.

Neither is the value of these technology companies lost on overseas investors. Artemis Intelligent Power was acquired by Mitsubishi Power Systems Europe in 2010. Crompton Technology Group, which produces the filament wound flywheels – and was itself spun from the group at the Harwell Laboratories involved in the ultracentrifuge development – was acquired by Goodrich (now UTC) also in 2010.

The evolution of these technologies for transportation use has been helped by co-funding from national funding programmes for innovation, in the field of environmentally friendly transport.

For instance:

- the Bombardier Transportation project is supported by the Technology Strategy Board's Accelerating Innovation in Rail programme
- the application of Artemis' Digital Displacement technology to hydraulic hybrid transmissions for automotive applications was demonstrated with support from the Department for Transport via its R&D programme, managed by the Energy Saving Trust
- the Ricardo Kinergy flywheel energy recovery system, together with the Torotrak CVT system for energy transfer, has featured in collaborative projects for car, bus and commercial vehicles supported by the Technology Strategy Board's Low Carbon Vehicles Innovation Platform.

www.bombardier.com/en/transportation

www.artemisip.com

www.alstom.com/uk

www.williamshybridpower.com

www.ricardo.com

10 Research and education

Features

88 RRUKA

88 University of Southampton

89 University of Birmingham Centre for Railway Research and Education

89 Imperial College London – The Future Rail Research Centre (FRRC)

90 NewRail – The Centre for Research at Newcastle University

90 University of Sheffield

91 University of Huddersfield Institute of Railway Research

92 University of Nottingham

Image: University of Huddersfield

Research and education

UK Universities play an important role in railway research and education, not just to the benefit of the UK rail sector but rail organisations around the world.

Around 40 UK institutions are involved in rail-related research activities, from short-term consultancy projects to longer-term masters and PhD projects. Much of this research is directly funded and in partnership with industry.

On these pages we highlight the work of the leading universities involved in railway research.

Image: University of Huddersfield

RRUKA

The Rail Research UK Association (RRUKA) is a partnership between the British rail industry and UK universities. Its aims are:

- the support and facilitation of railway research in academia
- the common understanding of research needs to support the rail industry and its future development
- the identification of research, development and application opportunities in railway science and engineering
- the provision of solutions to the rail industry.

Co-funded by the Rail Safety Standards Board (RSSB) and Network Rail, RRUKA provides a focus for research institutions undertaking R&D that might benefit the railways, and allows the railway industry to access academic research capabilities. It brings together those who can use and fund research with those who do it.

To do this RRUKA provides a forum for targeted knowledge exchange between universities and the industry, and organises focused workshops and seminars, as well as wider networking opportunities.

RRUKA also maintains a "map" of expertise to help identify experts in particular areas. It collates knowledge of what is being researched or has been researched, so that it is not duplicated when further research is being considered and undertaken.

www.rruka.org.uk

University of Southampton – Track 21 Project

The University of Southampton carries out interdisciplinary research and consultancy on railway systems that draws on engineering, physical and social sciences; integrates scientific theory with practical applications; and is international in scope, covering the UK, Europe and beyond. Its key areas of expertise include infrastructure, track systems, noise and vibration, timetabling, planning and operations, tribology, signalling and on-board systems.

The university is a Network Rail strategic university partner and has completed work for a range of clients, including the European Commission, the UK's Department for Transport, the Association of Train Operating Companies, Arup, Bombardier, Hitachi, HS1, ORR, RSSB, SNCF and Thales.

The £3.1 million Research Council-funded Track 21 project is developing a better understanding of the engineering, economic and environmental performance of railway track. This will provide the science needed to underpin a radical overhaul of techniques for railway track design, construction and maintenance. The project combines laboratory and field-based research to generate insights which can support a step change in infrastructure asset performance. Examples of this research include the use of discrete element modelling to improve our understanding of ballast micro-mechanics; laboratory testing of a range of sleeper-ballast combinations using a large scale rig; and measuring wheel-rail roughness and track vibration decay rates in the laboratory and in the field. A wide range of industry and governmental stakeholders support the project, and this allows research to be targeted to relate directly to rail industry needs. This also means results can be quickly disseminated to those who can make best use of them in practice.

www.southampton.ac.uk

University of Birmingham Centre for Railway Research and Education – assisting the international rail industry

By staff and student numbers, as well as by its activity, the Birmingham Centre for Railway Research and Education (BCRRE) is the UK's largest railway-focused research centre and one of Europe's biggest university-based centres. Part of the University of Birmingham, the centre has a long-standing and well-recognised profile in the industry, having expanded its research and teaching, both at home and overseas in recent years. BCRRE's international activities have been boosted by involvement in research programmes funded by the European Commission, industry-funded projects, and overseas strategic partnerships.

Since 2004, the centre has taken part in nine projects under the EU's Sixth and Seventh Framework Programmes, which fund and support cross-border research and development. It has also prepared a number of successful project proposals on behalf of consortia and was recently awarded a grant from the European Regional Development Fund to work with small to medium-sized businesses (SMEs) in the West Midlands. Preparations are now underway to approach the new Horizon 2020 programme, the EU's biggest research and innovation programme ever, which has nearly €80 billion of funding available. It is also preparing proposals to the Shift2Rail Joint Technology Initiative, a public-private partnership investing just under €1 billion in targeted research and innovation to encourage more passengers and freight to use Europe's railways.

Industry-funded projects include collaboration with the Singapore Land Transit Authority to develop an energy simulation tool to help with the selection of new rolling stock. Major international manufacturers are using the centre's research to verify their rolling stock's energy consumption and, for a number of years, centre staff have been conducting research together with staff from Central Japan Railways (CJR) seconded to Birmingham. Current projects centre on enhanced service management and timetabling for high speed lines and points condition monitoring.

In 2013 the centre developed a strategic partnership with China's Anhui Provincial Government, resulting in the formation of the Anhui/Birmingham International Research Institute in Railway Transportation (ABIRIRT). ABIRIRT will act as a platform both to trial and test new technologies and as a mechanism to introduce UK railway technical businesses to the Chinese market. ABIRIRT projects are already underway in the fields of signalling system simulation, asset condition monitoring, driving advisory systems and energy consumption reduction.

www.birmingham.ac.uk/research/activity/railway/

Imperial College London – the Future Rail Research Centre (FRRC)

The Future Rail Research Centre (FRRC) at Imperial College London is engaged on projects that include energy use on railways, including lifecycle costing of vehicles and infrastructure; condition monitoring of infrastructure, including switches and crossings in a major project for Network Rail; and the development of high speed rail in the UK.

The centre is led by Professor Roderick A Smith, who has more than 30 years' experience of railways in Japan. He was instrumental in persuading Lord Adonis that the UK needed a high speed railway system and has worked closely with High Speed 2 since the inception of the project.

The centre has in the past trained, and continues to train, PhD students who will play major roles in the technical development of high speed railways, in the UK and elsewhere. Several have spent periods being trained alongside the world-class engineering staff at the Railway Technical Research Institute in Tokyo.

Topics being investigated for High Speed 2 include the aerodynamics of high speed trains in tunnels, leading to increased drag and energy use, optimisation of energy use with journey time and operational parameters.

Professor Smith is chief scientific adviser at the Department for Transport and a member of the Singapore Metro's Technical Advisory committee.

www3.imperial.ac.uk/merailways

University of Sheffield – Railway Innovation and Technology Research Centre

The University of Sheffield has a wealth of railway research expertise in its Faculty of Engineering, and hosts the Railway Innovation and Technology Research Centre, funded by Network Rail. The faculty has an annual research income of around £46 million, producing more than 700 high-quality graduates each year. Key areas of research at Sheffield are in:

- rail-wheel interface, adhesion, wear and materials performance
- rail system design for safety and security
- performance of masonry arch bridges
- composite materials.

Research on the rail-wheel interface includes mechanical testing, contact mechanics, wear, fatigue, metallurgy, materials performance, and modelling how rail damage "adds-up" under specific traffic patterns.

Sheffield is expert in designing resilience into stations and vehicles, aiming to lower the risk and impact of attack, and make recovery faster. An essential aspect of this work is how travellers and operators accept change in the design of stations or rail vehicles, and linking design decisions to risk assessment. The modelling work done by the centre includes predicting the effects of a blast on station and vehicle structures, predicting fluid flow within stations, and anticipating crowd behaviour in emergency situations.

Design and manufacture of composite components is a major research area at the university, and that's being applied in the development of a railway sleeper from recycled polymer materials. What's more, a bespoke full-size sleeper testing equipment built and hosted at Sheffield is supporting that work. These facilities have been used to conduct fatigue tests of more than five million cycles on prototype sleepers.

www.sheffield.ac.uk

NewRail – the Centre for Research at Newcastle University

NewRail is the Centre for Railway Research at Newcastle University. Its aim is to deliver research, information and consultancy to meet the complex technological and managerial challenges of the rail industry. It has established strong research and consultancy links with railway operators and manufacturers in the UK and internationally.

NewRail is the preferred university research supplier to Bombardier Transportation, particularly when it comes to materials and structures, and one of the Alstom Transport top 10 rail engineering universities in the world. Not only that, NewRail is the preferred university consultancy supplier to Siemens Maintenance (UK) and the only university on the UITP (International Association of Public Transport) advisory board.

NewRail is a member of the European Rail Research Advisory Board (ERRAC) and a member of the International Rail Research Board (IRRB). In the past five years alone, it has been involved in rail projects that have a total project value of over €100 million, and these have involved more than 200 different international partners.

The centre co-ordinates its activities under the following themes: Strategy, Research, Education and Consultancy – its research activities cover rail vehicles, systems, infrastructure, freight and logistics.

Research conducted by NewRail on rail vehicles and systems, for instance, includes:

- designing and manufacturing a lightweight driver's cab in partnership with Bombardier Transportation and cab manufacturer AP&M
- increasing the safety and security of metro vehicles with respect to terrorist attacks by explosives and firebombs
- investigating and demonstrating the viability of an integrated train management system to achieve more sustainable and optimised energy use.

www.ncl.ac.uk/newrail

University of Huddersfield Institute of Railway Research – developing solutions for tram-train vehicles

Under contract by Network Rail, a team of engineers at the University of Huddersfield's Institute of Railway Research (IRR) has been developing solutions for the challenging interface between a tram-train vehicle and two very different railway infrastructures.

The tram-train concept allows a railway vehicle to run in two operational modes: as an on-street tram serving city centres but also as a commuter train running on existing local rail network. This dual operation concept provides great flexibility and efficient use of railway infrastructure and connections.

The Sheffield-Rotherham Tram-Train scheme represents the UK's first trial of the concept and has provided the project partners, the Department for Transport, Network Rail, Northern Rail, Stagecoach Supertram (SST) and South Yorkshire Passenger Transport Executive with many challenges. One of these is the wheel-rail interface, key to the vehicles' safe operation and a major driver for the ongoing lifecycle maintenance costs of the system.

By applying advanced computer modelling techniques, the team at the IRR has been able to predict vehicle dynamic behaviour on both the tight radius curves of embedded city centre track and also the higher speed but less curvaceous sections on Network Rail mainline. These differing conditions require an interface design which maintains vehicle dynamic stability on straight track, while allowing adequate curving performance and derailment resistance in the city centre – a classic engineering compromise in railway vehicle dynamics.

The wheel design work was complicated by the very different rail head shapes of the two systems; the SST network having a very flat rail head profile, while the worn Network Rail sections typically have a much smaller effective rail head shape. This called for a compromise in the wheel and tread design, with significant simulation work to optimise the new wheel profile shape. This allowed wheel-rail contact stress and wear rates to be minimised on both systems, while also maintaining safety against derailment.

The wheel profile also needed to operate under differing wheelset geometry conditions. This required a special stepped wheel flangeback to maintain safe passage through both Network Rail and SST switches and crossings and checked curves.

www.hud.ac.uk/research/researchcentres/irr/

University of Nottingham – Advanced Composite Integrated Structure project

The University of Nottingham has a strong track record in transport research and technologies, spanning aerospace, automotive and rail applications.

As one of the UK's top six universities for collaboration with industry, it has an impressive record of working with blue-chip, global businesses as well as with small- and medium-sized enterprises. The university's ethos is to gain a deep understanding of businesses, allowing it to respond to individual needs – engaging with clients for the long term to develop a partnership of mutual benefit.

The university has a portfolio of key industry partnerships across the rail sector, including Network Rail, for whom it is a strategic university partner. Its expertise and capabilities in rail are diverse and include power electronics; conversion and energy storage; infrastructure asset management; track bed structures; composites for vehicle light-weighting; human factors for safety and improving the customer experience; and train positioning using satellite navigation. The university is also actively seeking new partners in the rail sector who wish to collaborate to tackle shared research and technology challenges.

Part-funded by the UK's FutureRailway Enabling Innovation Fund via the Radical Train scheme, the Advanced Composite Integrated Structure project is led by Bombardier Transportation in partnership with the University of Nottingham, The National Composites Centre and EPL Composite Solutions Limited.

The potential for weight saving with structural carbon fibre composites is well understood, but high costs and perceived risks in approvals have previously limited their use in rail. Recent developments in reduced-cost manufacturing processes and a desire to reduce the weight of trains has created the opportunity for rail vehicles to benefit from this technology. This project assesses those opportunities, will gain industry agreement on compliance with approval processes and develop a novel demonstrator to showcase how the technology can be applied in railway rolling stock. The project will also help develop unique expertise in the UK rail sector that can be exploited around the world.

www.nottingham.ac.uk/servicesforbusiness

Image: University of Huddersfield

More information

UKTI – here to help

Sourcing from the UK

This brochure illustrates just some of the expertise held by UK companies that support rail solutions globally.

If you need more information on UK rail products and services please refer to the associations and the individual companies featured or contact the Mass Transport team at UKTI.

Helping investors

With unrivalled local access and knowledge, UK Trade & Investment can offer overseas investors unique assistance with regulatory issues, access to industry networks around UK centres of excellence, as well as introductions to sector leaders and business contacts. It can also act as a voice of Government for business interests and offer continued support through the in-house investor development network, which provides assistance to companies once they have established a presence in the UK.

UK Trade & Investment supports overseas businesses seeking to establish a presence or expand in the UK by providing the necessary support and contacts.

Contact us: To discuss how the UK can help with your rail development contact the British Embassy or Consulate General in your country and speak with a UKTI representative. Or you can visit the UKTI website at www.ukti.gov.uk

Association of Train Operating Companies (ATOC)

www.atoc.org

ATOC is the official voice of the passenger rail industry and represents train operating companies to the Government, regulatory bodies, the media and other opinion formers on transport policy issues. Its remit includes co-ordinating joint activities for train operators and facilitating common train operator positions on many engineering and operational issues.

The Department for Transport

www.dft.gov.uk

The Department for Transport formulates UK transport policy.

The Derby & Derbyshire Rail Forum (DDRF)

www.derbyrailforum.org.uk

DDRF represents the largest cluster of rail companies in the world, with dedicated local support from city and county councils, the Local Enterprise Partnership (D2N2), UK Trade & Investment and other industry groups.

This support helps DDRF members find and access new markets and promote international expansion. It also helps bring new organisations to the region, to continue the growth of – and boost the reputation of – the region's rail industry.

DDRF membership isn't restricted to technology and manufacturing companies. Finance, legal and other support organisations also belong. Before joining DDRF, a minimum of 10 percent of a company's turnover should be rail related.

The Office of Rail Regulation

www.rail-reg.gov.uk

The Office of Rail Regulation is the combined safety and economic regulator for Britain's national rail network.

The Rail Alliance

www.railalliance.co.uk

The Rail Alliance spans all aspects of the Rail Sector to enable you to network, collaborate and innovate with suppliers and customers to enable you to thrive as a business.

Its aim is to provide advice, tailored assistance and, most importantly, to identify and pass on business development opportunities at home and abroad to those in the rail sector.

The Rail Alliance does this through its extensive range of contacts and its well-respected programme of networking events, rail-focused seminars, its knowledge transfer partnerships with academe and its knowledge of what business support is available from the public and private sectors.

Rail Delivery Group

www.raildeliverygroup.com

The Rail Delivery Group (RDG) brings together the owners of Britain's train operating companies, freight operating companies and Network Rail to provide leadership to Britain's rail industry.

The RDG focuses on industry-wide issues. Its work is in the context of the need for improved services to rail users and value for money for taxpayers.

The Railway Industry Association

www.riagb.org

The Railway Industry Association (RIA) is the representative body for UK-based suppliers of equipment and services to the worldwide industry. It has around 180 member companies, active across the whole range of railway supply.

RIA provides its members with extensive services, including:

- provision of technical, commercial and political information
- representation of the supply industry's interests to Government, Network Rail and others
- providing opportunities for dialogue and networking
- supply chain improvement initiatives
- export promotion activity, through briefings, visits overseas, hosting inwards visits and organising UK presence at exhibitions overseas.

In doing so, RIA works very closely with UKTI. RIA's website provides links to all its member companies, combined with a search facility to allow clients to find potential suppliers of particular products or services quickly and efficiently.

Rail Freight Group (RFG)

www.rfg.org.uk

RFG promotes cost-effective rail solutions for freight. It has more than 150 member companies, including rail freight customers, logistics providers, suppliers, terminal operators, ports, transport consultants, retailers, legal firms and all freight train operating companies.

RSSB

www.rssb.co.uk

RSSB supports the rail industry in understanding risk, guiding standards, driving research and innovation, and improving performance, all in a range of services by the whole industry, for the whole industry, to deliver a better railway.

Transport Scotland

www.transportscotland.gov.uk

Transport Scotland is the national transport agency for Scotland.

Rail Supply Group

In November 2013, the UK Government announced that a new body – the Rail Supply Group – would be created to strengthen the capability and competitiveness of the UK rail supply chain to win business at home and abroad.

The group's aim is to co-ordinate industry and government action to create a stronger rail sector, which can make a greater contribution to the Government's key priorities of promoting economic growth, sustainable development and regional cohesion.

BUSINESS IS GREAT BRITAIN

UK Trade & Investment

ukti.gov.uk

UKTI
UK Trade & Investment is the Government Department that helps UK-based companies succeed in the global economy. We also help overseas companies bring their high-quality investment to the UK's dynamic economy acknowledged as Europe's best place from which to succeed in global business.

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Published May 2014
by UK Trade & Investment
URN 14/667

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